

**HYDROGEOLOGIC WELL  
COMPLETION REPORT  
GUNNISON COPPER PROJECT  
COCHISE COUNTY, ARIZONA**

by Haley & Aldrich, Inc.  
Phoenix, Arizona

for Excelsior Mining Corp.  
Phoenix, Arizona



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# 1. Introduction

Excelsior Mining Corporation (Excelsior) contracted Haley & Aldrich, Inc. (Haley & Aldrich) to provide field oversight of the drilling, construction, and testing of a series of hydrologic test holes for the Gunnison Copper Project site located in Cochise County, Arizona (Site; Figure 1). Haley & Aldrich prepared a Hydrogeologic Conceptual Model (Haley & Aldrich, 2012) and provided assistance to address the technical requirements of the Aquifer Protection Permit (APP) and Underground Injection Control (UIC) programs. Haley & Aldrich also recommended a well installation and testing program to support the hydrologic study required for the APP and UIC programs. Excelsior prepared the final well installation and testing program, prepared technical specifications, and selected contractors.

Haley & Aldrich provided field oversight and interpretation of data collected during the well installation and testing program. This report summarizes data collected by Haley & Aldrich during the borehole drilling, borehole analysis, well installation, and development activities. Results from the aquifer testing program and groundwater quality sampling results will be summarized in separate reports.

## 1.1 BACKGROUND

### 1.1.1 Site Description

The Site is located approximately 65 miles east of Tucson, Arizona on the southeastern flank of the Little Dragoon Mountains in the Johnson Camp Mining District (Figure 1). The Gunnison Copper Project contains copper oxide and sulfide mineralization in two deposits which are referred to as the North Star and South Star deposits. The wells completed in the drilling program summarized in this report were completed within the footprint of the North Star Deposit.

### 1.1.2 Geologic Setting

The Site is located within the Basin and Range physiographic province of southeast Arizona. Tertiary-aged, large-scale normal faulting has resulted in a series of upthrown mountain ranges and intervening basins filled with Tertiary- to Quaternary-aged unconsolidated to partially-consolidated alluvial sand, silt, clay, and cobbles.

The North Star Deposit is located along the southeastern slope of the Little Dragoon Mountains within a north-south trending basin bounded to the east by the Gunnison Hills (Figure 1). The Little Dragoon Mountains are an isolated, fault-bounded, upthrown block consisting of early-Tertiary Texas Canyon quartz monzonite stock which displaced and tilted the existing Paleozoic sedimentary rocks. The mineralized Paleozoic host rocks strike approximately north-northwest and generally dip between 20 and 45 degrees towards the east. As the basin developed, alluvial materials were deposited east of the Little Dragoon Mountains and basin fill thicknesses increased from the Little Dragoon Mountain front to approximately 1,800 feet thick immediately west of the Gunnison Hills (Harshbarger, 1973). In the vicinity of the North Star Deposit, basin fill thickness ranges from 200 to 300 feet along a minor bedrock high located just east-southeast of the deposit, to approximately 700 feet thick (or more) along the northeastern margin of the deposit (Groundwater Resources Consultants [GWRC], 1997).

The primary geologic features of the North Star deposit are:

1. Basin-fill alluvium (Tertiary to Quaternary).
2. Texas Canyon quartz monzonite stock (early Tertiary).

3. Sequence of east-northeast Paleozoic dipping rocks (in descending order):
  - Black Prince Limestone (Pennsylvanian/Mississippian);
  - Escabrosa Limestone (Mississippian);
  - Martin Formation (Devonian);
  - Upper, Middle, and Lower Abrigo Formation (Cambrian); and
  - Bolsa Quartzite (Cambrian).
4. Pinal Schist (Pre-Cambrian, Weitz, 1976).
5. A system of high-angle normal and reverse faults with dips ranging from 60 to 80 degrees.
6. Bedding parallel faults and fracture zones, primarily in the Martin and Upper and Middle Abrigo units (Independent Mining Consultants, 2011).

During intrusion of the Texas Canyon quartz monzonite, the Paleozoic sedimentary rocks were altered by contact metamorphism, physical displacement, and by hydrothermal fluids that migrated through pre-existing and contemporaneous fractures in the host rocks. These fluids precipitated copper sulfides primarily along existing fracture surfaces in a skarn-type deposit; some of the mineralized zone was subsequently oxidized via meteoric water processes. Copper sulfide mineralization has formed preferentially in the proximal (higher metamorphic grade) skarn facies, particularly along stratigraphic units such as the Abrigo and Martin formations, and within structurally complex zones. The intrusion also formed wide zones of calc-silicate and hornfels alteration within the Paleozoic rocks (Independent Mining Consultants, 2011).

## **1.2 AREA HYDROGEOLOGY**

Hydrogeologic units are generally based on rock types, aquifer properties, and water quality. They are grouped together based on similar water storage and transmission capabilities, as well as similar water quality. Hydrogeologic units identified within the study area include:

- Basin-fill alluvium;
- Paleozoic rocks within the mineralized zone;
- Paleozoic rocks outside of the mineralized zone; and
- Texas Canyon quartz monzonite.

A generalized understanding of the hydrogeologic units underlying the Site prior to this drilling program is summarized below.

### **1.2.1 Basin-Fill Alluvium**

Before the drilling program, there was limited existing data regarding the occurrence of groundwater in the basin fill alluvium overlying the North Star Deposit. There were two holes drilled in 2011-2012 that were completed in the basin-fill alluvium: NSD-020 and NSH-006. The borehole for NSD-020 was drilled to a total depth of 660 feet with a saturated basin fill alluvium thickness of approximately 30 feet. The borehole for well NSH-006 was drilled to approximately 684 feet and had approximately 40 feet of saturated alluvium.

Four alluvial wells were planned as part of the hydrologic investigation, one was installed and was dry; the other three were cancelled due to lack of saturated alluvium observed during the drilling of nearby boreholes completed to deeper intervals. In addition, an alluvial basin piezometer NSH-011 was installed by Excelsior during the investigation to the east of the North Star Deposit area. Because saturated alluvium was not identified at the planned locations of alluvial wells, the existing alluvial wells NSH-006 and NSH-011 were tested as part of the aquifer testing program; the results of those tests are summarized in the aquifer testing report.

### **1.2.2 Paleozoic Rocks within the Mineralized Zone Hydrogeology**

Hydrologic test wells installed during this investigation were primarily installed in the altered Paleozoic bedrock; prior to the investigation there were five existing hydrologic test wells and a series of open coreholes where water level data has been collected by Excelsior since 2012. The new wells will add to the understanding of the fractured bedrock hydrology and how the units and geologic features control the flow of groundwater.

### **1.2.3 Unaltered Paleozoic Sedimentary Rocks Outside the Mineralized Zone**

Two wells were planned in the unaltered Paleozoic rocks to the east of the North Star Deposit: NSH-018 and NSH-020. Prior to the investigation, no wells existed in the vicinity.

### **1.2.4 Texas Canyon Intrusives**

No hydrologic holes existed in the Texas Canyon quartz monzonite prior to this investigation. Two wells (NSH-015 and NSH-016) were installed in the Texas Canyon quartz monzonite during this investigation.

## **1.3 DRILLING AND WELL INSTALLATION PROGRAM**

The drilling and well installation program commenced on 16 October 2014 and included a total of 26 wells (5 piezometers and 21 hydrogeologic test wells). The planned well locations are identified using a two-letter symbol with an NSH prefix; the identifiers are assigned by Excelsior when well locations are planned in alphabetical order. Once a borehole has commenced at the planned location, a three-digit numerical identification is assigned with an NSH prefix. These numbers are assigned sequentially as the wells are started. During this investigation, wells NSH-007 through NSH-032 were installed.

The program was completed on 10 February 2015 and was immediately followed by development and testing activities. All work was completed with oversight from Haley & Aldrich staff, with the exception of NSH-011 which was completed with oversight from Excelsior staff. Drilling contractors included National Exploration Wells and Pump (NEWP) for drilling and installation of the hydrogeologic test wells, and BJ Drilling Company, Inc. (BJ Drilling) for drilling and installation of the piezometers. The drilling and well installation program was conducted on a 24-hour schedule using a total of three rigs. NEWP mobilized a GEFCO Speedstar 50K (50K) drilling rig and a Schramm T685WS (685) drilling rig to the Site to support the hydrologic well drilling activities. BJ Drilling mobilized an Ingersoll Rand T3W (T3) drilling rig to complete the piezometers.

Boreholes were generally drilled by the air-rotary hammer method using foam products to stabilize the borehole and assist in the removal of cuttings. Borehole instability was noted at five of the well locations; at two of those locations (NSH-014B and NSH-022), borehole instability prevented

advancement of the borehole by the air-rotary hammer method. In order to complete the holes to the targeted zones, the mud-rotary drilling method was utilized using a tri-cone bit. At seven locations (NSH-019, NSH-21C, NSH-017, NSH-018, NSH-020, NSH-022, and NSH-027), water production from the borehole during drilling exceeded the capacity of the air-rotary hammer equipment to function as designed. In these cases, it was necessary to use a tri-cone bit in an air rotary configuration to advance the boreholes to the target depth.

Following completion of the boreholes to the target depth, geophysical surveys were conducted by International Directional Services' Colog Group (IDS-COLOG) at all locations except the piezometers. The logging surveys included geophysical logs and hydrologic testing which are further described in Section 1.4.

The hydrologic test well installation program included four primary well designs to investigate well construction methods in support of a future feasibility study. The well designs included 1) 4-inch cased wells, 2) 6-inch cased wells, 3) 8-inch open borehole interval wells, and 4) piezometers. All of the wells included a surface casing installed to a minimum of 20 feet below land surface (bls), and a surface vault completed with a concrete pad and a locking cover. Construction methods specific to each design are summarized in the following sections, and specific construction details for each well are summarized in Section 2 and Table I.

### **1.3.1 Two-Inch Piezometers**

The 2-inch piezometers were installed in 6.5-inch diameter boreholes that were drilled from the bottom of the surface casing to the design depth. Piezometer casing consisted of 2 $\frac{3}{8}$ -inch outside diameter (0.154-inch wall thickness) low-carbon steel (LCS) blank casing and screen. The screen consisted of 0.125-inch wide vertical torch-cut slots with a steel bottom cap.

The contractor installed annular materials by the tremie and pump method including filter pack, bentonite chips, and high-solids bentonite grout or gravel. The filter pack was comprised of  $\frac{1}{4}$ -inch to No. 8 US Mesh Tacna gravel. The filter pack was installed from the total depth of the borehole to approximately 10 feet above the top of the screen, with a 10-foot thick interval of  $\frac{3}{8}$ -inch bentonite chips installed over the filter pack.

For the shallow piezometers (NSH-029 and NSH-030) where the water level was within the screened interval, formation stabilizer comprised of  $\frac{3}{8}$ -inch pea gravel or Tacna filter pack that was installed from the top of the bentonite chips to land surface. For the deeper piezometers (NSH-031 and NSH-032), high-solids bentonite grout was installed by the submerged tremie method using a pump from the top of the transition sand to land surface.

### **1.3.2 Four-Inch and Six-Inch Cased Wells**

The cased well boreholes were drilled to a 10-inch diameter for the 4-inch wells and a 12-inch diameter for the 6-inch wells. These boreholes were drilled from the bottom of the surface casing to the design depth of the well. Borehole geophysical logging was conducted after the borehole was drilled prior to well installation.

The 4-inch nominal diameter well design included 4.5-inch outside diameter (0.237-inch wall thickness) LCS blank casing and screen; the screen included 0.125-inch wide vertical mill slots and a steel bottom



cap. The 6-inch nominal diameter well design includes 6.625-inch outside diameter (0.25-inch wall thickness) LCS blank casing and screen; the screen consisted of 0.125-inch wide vertical mill slots and a steel bottom cap.

The contractor installed annular materials by the tremie and pump method including filter pack, transition sand, and high-solids bentonite grout. The filter pack was comprised of ¼-inch to No. 8 US Mesh Tacna gravel. The filter pack was installed from the total depth of the borehole to approximately 10 feet above the top of the screen. A fine transition sand interval comprised of No. 20 to 40 US Mesh sand was installed over the filter pack to prevent the high-solids bentonite grout from flowing downward into the filter pack and well.

High-solids bentonite grout was installed by the submerged tremie method using a pump from the top of the transition sand to land surface. If necessary, bentonite chips or formation stabilizer was used to fill the annulus to land surface.

### **1.3.3 Open Borehole Completion Wells**

The open borehole completion wells were generally installed to test the upper bedrock units or bulk bedrock properties, and were completed without materials to stabilize the intervals of the boreholes that were left open to bedrock. Drilling contractor activities associated with completion of the open borehole wells included installation of surface casing and seal; drilling and installation of intermediate casing and annular materials; drilling to the design depth; geophysical logging; and well-head completion.

A 20-inch diameter borehole was drilled to 20 feet. Surface casing consisting of 14-inch outside diameter (¼-inch wall thickness) LCS blank casing was installed to 20 feet, and grouted to surface using neat cement grout. A 13-inch borehole was drilled from the bottom of the surface casing to the design depth. A layer of bentonite chips (approximately 5 feet thick) was installed in the bottom of the 13-inch borehole, and 8-inch nominal diameter steel intermediate casing was installed with the 50-foot neat cement plug at the base and a high-solids bentonite grout seal to surface.

A 7⅝-inch diameter borehole was drilled from the bottom of the intermediate casing to the target depth. Geophysical logging was conducted in the open interval of the borehole during a subsequent geophysical contractor mobilization; geophysical logging was not completed in the intermediate casing interval.

At three locations (NSH-007, NSH-010, and NSH-016), the borehole collapsed after completing the 7⅝-inch diameter open borehole to the total depth. At these locations, the boreholes were cleaned out and polyvinyl chloride (PVC) liners were installed; details for the borehole cleanouts and liners are included in the corresponding well section below.

## **1.4 LITHOLOGIC DESCRIPTIONS AND GEOPHYSICAL LOGGING**

The lithology and structure of the formation penetrated by drilling activities were evaluated from descriptions of the drilled cuttings and geophysical surveys. Lithology for each well is described in more detail in Section 2 and lithology logs for each well are included in Appendix A. Table II provides a matrix of the geophysical logs completed at each well and results of the geophysical logging are discussed further in Section 2. Geophysical logs were used to confirm lithologic contacts and finalize well designs.

They will also be utilized by Excelsior to update the geologic model. Flow logging was conducted to identify flow zones that can be used to support the hydrologic investigation. Interpretation of the flow logging will be discussed in the aquifer testing report.

### **1.5 WELL DEVELOPMENT PROGRAM**

The development of each well was based on site-specific conditions, but generally involved mechanical methods including airlift, swabbing, bailing, and pumping activities. Chemical dispersant was added as necessary to assist in the development of wells which were drilled using the mud rotary method; details regarding the dispersants used at each well are included in the corresponding well development sections. Initially, an attempt was made to develop the boreholes using air pressure and the drill string prior to logging so that flow logging could be conducted in a single mobilization, but borehole instability issues at NSH-007 and NSH-010 precluded full development prior to geophysical logging. More details on the instability issues, depths, borehole cleanout, and installation of liners are included in the corresponding sections for each well.

Based on these observations, the decision was made to develop the 8-inch (open borehole completion) wells after geophysical logging was completed, and to develop the 4-inch and 6-inch wells after the casing and screen was installed. After conducting several flow logging surveys on undeveloped boreholes, the decision was made to cancel flow logging surveys on cased holes. Flow logging surveys of open borehole interval wells was not conducted until after development was completed in order to collect the most accurate and representative data possible; data that would not be impacted by any skin that may have formed on the borehole walls during drilling activities.

### **1.6 AQUIFER TEST PROGRAM**

Aquifer tests were conducted at all of the wells installed, with the exception of NSH-012 which was dry, and NSH-029 through NSH-032 which were piezometers installed as observation points for other testing locations. The results of the aquifer testing will be summarized in a separate report.

### **1.7 GROUNDWATER QUALITY TESTING**

Groundwater quality sampling was conducted at each of the hydrologic test wells, with the exception of NSH-012 because it was dry and piezometers NSH-029 through NSH-032. The groundwater quality will be summarized in a separate report.

### **1.8 COREHOLE DEVELOPMENT PROGRAM**

Existing coreholes at the site were developed in order to expand the monitoring network for aquifer testing activities. Initially, 15 coreholes were proposed to be developed, but during the course of the investigation the decision was made to expand the network even further. Details on the corehole development program are included in Section 3.

## **2. Drilling and Well Installation Summary**

### **2.1 WELL NSH-007**

Well NSH-007 was sited at location NSH-CP to characterize the Sechura fault, a significant east-west trending structural feature near the north end of the North Star Deposit. Well NSH-007 was planned for completion in the upper bedrock with the intention of penetrating the Sechura fault to conduct testing to evaluate potential flow across the Atacama and Patagonia faults.

The well design was an open borehole interval design with a planned depth of 625 feet. NSH-007 was drilled by NEWP using the 50k rig utilizing the air rotary method. Upon completion, a PVC liner was installed to stabilize the open interval; details are included in Section 2.1.4.

#### **2.1.1 Drilling and Casing Installation**

Drilling activities for well NSH-007 commenced on 16 October 2014. An 18-inch diameter borehole was drilled to 20 feet and LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and was grouted to land surface using neat cement grout.

The borehole drilling was continued on 17 October 2014 using a 12-inch diameter air-rotary hammer bit to a depth of approximately 484 feet on 18 October 2014. Prior to installation of the intermediate casing, the lower portion of the borehole was filled with filter pack from approximately 469 to 484 feet in order to include the upper portion of the Upper Abrigo in the open borehole completion. Bentonite chips were installed in the borehole from approximately 463 to 469 feet and installation of nominal 8-inch diameter intermediate casing commenced on 21 October 2014 to a depth of 469 feet. Cement-bentonite grout was mixed onsite and installed via tremie pipe from approximately 30 to 463 feet. Gravel, fine sand, and neat cement were installed from 30 feet to land surface.

The 7½-inch bedrock borehole drilling commenced on 21 October 2014 from 469 feet and was completed at a depth of 640 feet on 22 October 2014.

Well completion field forms are included in Appendix B, an as-built well diagram for NSH-007 is included as Figure 3, and well construction details are summarized in Table I.

#### **2.1.2 Geophysical Logging**

A geophysical logging survey of the open borehole interval of well NSH-007 was conducted by IDS-Colog on 26 October 2014; however, an obstruction in the borehole at approximately 510 feet prevented logging the entire borehole. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity, and
- Acoustic Borehole Televiewer.

Two attempts were made to clear the obstruction in well NSH-007. On 11 November 2014, the borehole was cleaned out to the total depth; geophysical logging was attempted but the borehole had filled to approximately 515 feet.

The second attempt to clear the obstruction in well NSH-007 included installation of a PVC liner to facilitate the pumping test and is detailed in Section 2.1.4. No additional logs were run due to borehole instability. Copies of the geophysical logs are included in Appendix D.

### 2.1.3 Lithology

The bottom of the alluvium was penetrated at approximately 320 feet. The alluvium consists of clay with sand from land surface to approximately 20 feet, overlying sand with gravel to the bottom of the unit. The upper portion of alluvium (to approximately 130 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit is composed of approximately 85 percent granitic clasts and approximately 15 percent non-granitic clasts. There was no evidence of saturation in the alluvium.

The Martin Formation was encountered directly beneath the alluvium. The occurrence of groundwater was first noted at approximately 350 feet when no makeup water was utilized and a small amount of water discharge with the drilled cuttings was observed. An attempt was made to estimate the water level; however due to the low transmissivity and water production of the upper bedrock, the air rotary drilling method obscured the static water level during drilling. The Martin Formation was completely penetrated by the borehole and the top of the Upper Abrigo Formation was encountered at approximately 470 feet and extended to the total depth of the borehole. A detailed lithologic log is included in Appendix A.

### 2.1.4 Borehole Cleanout and Liner Installation

On 10 February 2015, NEWP mobilized to well NSH-007 with the 50k drilling rig and converted the tools to drill by the dual-tube reverse air-rotary drilling method to clean out the borehole for installation of a PVC liner. Cleanout activities commenced on 11 February 2015 and the obstruction was encountered from approximately 510 feet to 620 feet, with voids from 580 to 590 feet and 600 to 610 feet. Obstruction material appeared consistent with the lithology of the drilled cuttings from the Abrigo Formation. The borehole was deepened to approximately 640 feet to accommodate potential fill during installation of the liner. The borehole was airlifted until the discharge of drilling fluids was minimal and the concentration of cuttings in the discharge decreased significantly (to less than approximately 2 milliliters per liter [ml/L]) prior to removal of the drill bit. However after removal of the bit, the fill was measured at approximately 509 feet. On 12 February 2014, fill was measured at approximately 502 feet and an additional attempt was made to clean out the borehole using the same method. During cleanout, the driller noted significant return of cuttings from the 530- to 540-foot interval prior to reaching total depth. The borehole was circulated until the concentration of cuttings in the discharge decreased significantly (to approximately 0.3 ml/L) prior to removal of the drill bit. After removal of the bit, fill in the borehole was measured at approximately 500 feet.

Bentonite-based drilling fluid was added on 13 February 2015 to stabilize the borehole during cleanout to approximately 640 feet. The borehole remained open and a 4-inch nominal diameter PVC liner (schedule 40 wall thickness) was installed. The design of the liner included screened intervals (0.100-inch wide horizontal perforations) from approximately 356 to 496 feet and from 536 to 616 feet, with a bottom cap at approximately 616 feet. The blank interval of casing was installed between approximately 496 to 536 feet as an optional pump gallery due to potential fill re-entering the borehole. The well as-built diagram is included as Figure 3.

### 2.1.5 Well Development

Prior to conducting the geophysical logging of the open borehole interval, the borehole was developed by airlift for approximately 10 hours with the bit at the bottom of the borehole on 23 October 2014. The purpose of the borehole development was to improve the quality of data collected during the flow logging exercise. The discharge rate during airlift development was estimated at approximately 20 gallons per minute (gpm). The concentration of solids in the discharge generally decreased over the development period from approximately 25 to 5 ml/L, and appeared to have a lithology consistent with the drilled cuttings.

Additional development was conducted from 15 to 16 February 2015 after installation of the liner to remove drilling fluids required to install the liner. A submersible pump (Grundfos model 40S100-30) was installed to approximately 595 feet and purging of drilling fluids commenced. On 16 February 2015, pump development continued and the discharge was clear and generally sand free at the end of the day. The static water level was measured at approximately 346 feet prior to additional pump development by the pump and surge method, which included several hours of pumping at three rates (between approximately 4 and 15 gpm) with recovery periods between pumping. At the end of the development period, the discharge from NSH-007 was clear and free of sand. Field forms documenting well development are included in Appendix C.

## 2.2 WELL NSH-008

Well NSH-008 was sited at location NSH-CQ to characterize the interior of the structural block located between the Gibson, Sechura, and Little Sandy faults. Well NSH-008 is located on the opposite side of the Sechura fault from Well NSH-007. Well NSH-008 was planned for completion in the lower oxide bedrock with possible penetration of the Little Sandy fault. This well location is also sited at a shallow occurrence of the Abrigo.

Well NSH-008 is a 4-inch cased well and the planned depth of was 905 feet; the well was drilled by NEWP using the 50k drilling rig and the air rotary method.

### 2.2.1 Drilling and Well Installation

Drilling activities for well NSH-008 commenced on 24 October 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS steel surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 24 October 2014 using a 10-inch diameter air-rotary hammer bit to a depth of 900 feet. Installation of well NSH-008 commenced on 28 October 2014 after geophysical logging was completed. The well included 4-inch nominal diameter LCS; blank casing was installed to 720 feet and the screened interval extended from 720 to 840 feet. The filter pack was installed from the top of the fill to 711 feet, transition sand was installed to 700 feet, and installation of high-solids bentonite grout to land surface was completed on 30 October 2014.

On 20 November 2014, the level of the bentonite grout in the annulus was observed to have dropped to approximately 191 feet. The annulus was filled with ¾-inch bentonite chips from approximately 191 to 80 feet, and Tacna gravel was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NHS-008 is included as Figure 4, and well construction details are summarized in Table I.

### 2.2.2 Geophysical Logging

A geophysical logging survey of the NSH-008 borehole was conducted by IDS-Colog and commenced on 26 October 2014; however on 27 October 2014, a portion of the borehole collapsed at approximately 400 feet during logging. The borehole was cleaned out to the total depth the same day using the same drilling rig. The geophysical survey was completed 28 October 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic,
- Acoustic Borehole Televiwer,
- Gamma-Gamma Density,
- Neutron, and
- Heat Pulse Flow-Meter.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report.

The heat pulse flow-meter was used due to lack of availability of the electromagnetic flow-meter to measure vertical flow of groundwater in the borehole. The heat-pulse tool collected data from 17 stationary positions (working downward) between approximately 350 and 854 feet. Slight upward flow (between approximately 0.2 and 0.9 gpm) was measured at approximately 603, 625, and 654 feet. Measurement of vertical flow in the borehole during injection was attempted; however, the heat pulse tool had been filled with solids from the borehole and prevented the tool from functioning as designed after the initial static downhole run. After logging was completed, the top of the fill was measured at approximately 854 feet. Copies of the geophysical logs are included in Appendix D.

### 2.2.3 Lithology

The bottom of the alluvium was encountered at approximately 310 feet. Penetration rates in the alluvium were generally between approximately 0.6 and 1.5 minutes per foot. The alluvium consists of clay with sand from land surface to approximately 30 feet, and overlying clayey sand to approximately 70 feet. Sand with gravel was encountered from approximately 70 feet to the bottom of the alluvium at 310 feet. The upper portion of alluvium, from approximately 70 to 130 feet, is comprised of approximately 50 to 70 percent granitic clasts and approximately 30 to 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit (below approximately 130 feet) is comprised of approximately 90 percent granitic clasts and 10 percent non-granitic clasts.

The Martin Formation was encountered immediately below the alluvium at 310 feet to 460 feet. Penetration rates in the Martin Formation were generally between approximately 1.0 and 2.0 minutes per foot and no evidence of groundwater was observed.

The top of the Upper Abrigo Formation was encountered at approximately 460 feet to 490 feet. Penetration rates in the Upper Abrigo formation were between approximately 1.1 and 1.6 minutes per foot. Based on a change in lithology, the top of the Middle Abrigo formation was encountered at approximately 560 feet and penetration rates decreased (compared to the Upper Abrigo formation) to between approximately 1.5 and 4.6 minutes per foot. The occurrence of groundwater during drilling was first noted when drilling from 720- to 740-foot interval; no makeup water was being used and approximately 15 gpm of water discharged with the drilled cuttings. The penetration rate in this interval was approximately 1.0 minutes per foot, compared to the higher rates above and below this interval. These observations suggest the interval from 720 to 740 feet is consistent with an open feature such as a fracture zone. The Lower Abrigo was encountered at approximately 740 feet; penetration rates in the Lower Abrigo formation were between approximately 1.6 and 2.6 minutes per foot. The groundwater discharge rate during drilling did not increase with depth.

The Little Sandy fault was not penetrated by NSH-008. However, fracturing encountered between 719 and 765 feet has an orientation similar to the Sechura fault and may reflect a splay of that fault. A detailed lithologic log is included in Appendix A.

#### **2.2.4 Well Development**

After drilling to the total depth, the borehole was developed by airlift for approximately 6 hours with the bit at the bottom of the borehole on 26 October 2014. The discharge rate during airlift development was estimated at approximately 10 gpm. The concentrations of solids in the airlift discharge were generally consistent over the development period (between approximately 5 and 20 ml/L with approximately 20 to 30 percent gravel), and appeared consistent with the lithology of the drilled cuttings from bedrock. Airlift development of the borehole stopped when cuttings consistent with the alluvium were predominately observed in the discharge. After the bit was removed from the borehole, the water level was measured at 390 feet on 26 October 2014 and was observed to be slowly recovering. On 27 October 2014, the water level was measured at approximately 348 feet.

After installation of the well, tremie pipe was installed as an airline to airlift develop the well with the drilling rig. The well was airlift developed for a total of approximately 12 hours on 30 October 2014; the airline was initially installed to approximately 695 feet and was worked down to approximately 835 feet by the end of the development period. The discharge rate was approximately 15 gpm. The sand content, turbidity, and discharge rate did not appear to change during the development period.

Further development was conducted by NEWP using a pump rig. On 22 December 2014, the water level in well NSH-008 was measured at approximately 333 feet prior to development. A tightly fitting swab tool was reciprocated through the screened interval for approximately one hour and the solids were bailed prior to pumping. A Grundfos submersible pump (model 40S100-30) was installed with the intake at approximately 709 feet. Pump development was conducted; pump rates were initially low (approximately 7 gpm) and were increased gradually with each pumping period to a maximum rate of approximately 25 gpm. The discharge was clear and free of sand at the end of the 8-hour development period. Field forms documenting well development are included in Appendix C.



## 2.3 WELL NSH-009

Well NSH-009 was sited at location NSH-CS to characterize the structural block located between the Gibson, Chihuahua, and Patagonia faults. Well NSH-009 is located on the opposite side of the Gibson fault from Well NSH-008, and was expected to intercept the steeply dipping Gibson fault at depth. The Gibson fault geometry is poorly constrained due to a lack of data. Well NSH-009 was planned for completion in the lower oxide bedrock.

Well NSH-009 is a 4-inch cased well design with a planned depth of 1,180 feet. It was drilled by NEWP using the 685 drilling rig and the air rotary method.

### 2.3.1 Drilling and Well Installation

Drilling activities for well NSH-009 commenced on 30 October 2014; a 20-inch diameter borehole was drilled to 20 feet, LCS casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued from 31 October 2014 to 3 November using a 10-inch diameter air-rotary hammer bit to 1,060 feet. Installation of well NSH-009 commenced on 4 November 2014 after geophysical logging was completed. The well included 4-inch nominal diameter LCS; blank casing was installed to 813 feet and the screened interval extended from 813 to 995 feet. Installation of annular materials commenced on 7 November 2014. Filter pack was installed to approximately 795 feet, transition sand was installed to approximately 785 feet, and high solids-bentonite grout was installed to land surface on 8 November 2014.

The top of the high-solids bentonite grout in the annulus was observed to have dropped to approximately 590 feet by 23 November 2014. Additional high-solids bentonite grout was installed to 353 feet, bentonite chips were installed to 337 feet, Tacna gravel was installed to 6 feet, and bentonite chips were installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-009 is included as Figure 5, and well construction details are summarized in Table I.

### 2.3.2 Geophysical Logging

A geophysical logging survey of the borehole for well NSH-009 was conducted by Colog and commenced on 3 November 2014. Prior to logging, the water level was measured at approximately 563 feet. The geophysical survey was completed 4 November 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic,
- Acoustic Borehole Televiwer,
- Gamma-Gamma Density,
- Neutron, and
- Static and dynamic electromagnetic flow-meter.



The geologic logs collected were used in the interpretation of the lithology for the final well design and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### **2.3.3 Lithology**

The alluvium consists of clay and sandy silt from land surface to approximately 40 feet; overlying sand with silt and gravel and silt with sand to the bedrock contact at approximately 480 feet. Penetration rates in the alluvium were generally between approximately 0.3 and 1.5 minutes per foot. The upper portion of alluvium (from approximately 60 to 110 feet) is comprised of approximately 75 to 80 percent granitic clasts and approximately 20 to 25 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit (below approximately 110 feet) is comprised of approximately 80 to 90 percent granitic clasts and approximately 10 to 20 percent non-granitic clasts.

The Escabrosa Formation was encountered beneath the alluvium at approximately 480 feet. Drilled cuttings from the Escabrosa Formation appeared white and minor concentrations of iron oxides were noted. The Martin Formation was encountered from approximately 520 to 660 feet, appeared gray to white in color, and included concentrations of copper and iron oxide minerals. Penetration rates in the Escabrosa and Martin formations were generally between approximately 1.0 and 2.4 minutes per foot; no evidence of groundwater was observed during drilling.

The top of the Upper Abrigo Formation was encountered from approximately 660 to 790 feet. Penetration rates in the Upper Abrigo Formation were between approximately 0.9 and 1.5 minutes per foot. Based on a change in lithology, the top of the Middle Abrigo Formation was encountered at approximately 790 feet and penetration rates decreased (compared to the Upper Abrigo Formation) to between approximately 1.6 and 5.3 minutes per foot. The Lower Abrigo Formation was encountered at approximately 1,000 feet. Penetration rates in the Lower Abrigo Formation were between approximately 2.0 and 4.0 minutes per foot. Well NSH-009 was planned for a depth of 1,180 feet, but drilling was terminated at a depth of 1,060 feet in the Lower Abrigo due to the fact that mineralogical interpretation by Excelsior staff indicated that the bottom of the oxide had been reached and the hole was advancing into the non-mineralized sub-ore body zone. The Gibson fault was not intercepted by Well NSH-009. A detailed lithologic log is included in Appendix A.

### **2.3.4 Well Development**

Development of well NSH-009 was conducted by NEWP and included swabbing, bailing, and pumping. Prior to development, the water level was measured at approximately 406 feet on 22 December 2014. A tightly-fitting swab tool was reciprocated on a wireline through the screened interval for approximately 2 hours and the solids were bailed from the well.

Well NSH-009 was developed by pumping on 3 and 4 January 2015. Prior to development, the static water level was measured at approximately 407 feet. NEWP installed a Grundfos submersible pump (model 40S100-30) with the intake at approximately 595 feet. Pump and surge development on 3 January 2015 extended for approximately 2 hours and included 20- to 30-minute pumping periods and 10-minute recovery periods. Purge rates were initially high (approximately 40 gpm) and were allowed

to decrease as the pumping water level dropped. The pump was lowered to approximately 742 feet to accommodate more drawdown. Pump development on 4 January 2015 included pumping for a total of approximately 4 hours and pumping periods at approximately 7 and 10 gpm. Field forms documenting well development are included in Appendix C.

## **2.4 WELL NSH-010**

Well NSH-010 was sited at location NSH-CT to characterize the structural block located between the Gibson, Chihuahua, and Patagonia faults. Well NSH-010 was planned for completion in the upper oxide bedrock, with no fault intercepts.

Well NSH-010 is an open borehole interval well with a planned depth of 750 feet; the well was drilled by NEWP using the 50k drilling rig, and the air rotary method. Upon completion, a PVC liner was installed to stabilize the open interval; details are included in Section 2.4.4.

### **2.4.1 Drilling and Casing Installation**

Drilling activities for well NSH-010 commenced on 30 October 2014; a 20-inch borehole was drilled to 20 feet, an LCS casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued from 31 October to 1 November 2014 using a 13-inch diameter air-rotary hammer bit to 546 feet. Installation of the 8-inch nominal diameter LCS intermediate casing was completed on 1 November 2014, neat cement grout was installed to approximately 486 feet, and high-solids bentonite grout was installed to land surface.

Bedrock borehole drilling commenced on 2 November 2014 using a 7½-inch air-rotary hammer bit; the borehole was completed on 3 November 2014 to a depth of 720 feet.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 6, and construction details are summarized in Table I.

### **2.4.2 Geophysical Logging**

A geophysical logging survey of open borehole interval of well NSH-010 was conducted by IDS-Colog on 4 November 2014; however, an obstruction in the borehole at approximately 660 feet prevented logging the entire borehole. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity, and
- Sonic.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.4.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 490 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 1.2 minutes per foot, but rates as slow as 2.25 minutes per foot were observed over short intervals. The alluvium consists of sandy lean clay with gravel from land surface to approximately 10 feet, silty sand with gravel from approximately 10 to 40 feet, sand with silt and gravel from approximately 40 feet to 70 feet, sand with gravel from approximately 70 feet to 180 feet, silty sand from approximately 180 feet to 230 feet, and sand with silt from 230 feet to 490 feet. There was no evidence of saturation in the alluvium.

The Escabrosa Formation was completely penetrated by the borehole, and the top of the Martin Formation was encountered at approximately 610 feet. Penetration rates in bedrock were between approximately 0.6 and 1.75 minutes per foot to a total depth of approximately 720 feet in the Martin Formation. Fault gouge was observed in the drilled cuttings at approximately 620 feet, which was interpreted to be a minor fault along the bedding plane between the Escabrosa and the Martin formations. A detailed lithologic log is included in Appendix A.

### 2.4.4 Borehole Clean Out and Liner Installation

On 14 February 2015, NEWP mobilized to well NSH-010 with the 50k drilling rig. Initially, the dual-tube reverse air-rotary drilling method was used to clean out the borehole to total depth from the top of obstruction at approximately 610 feet. Initial discharge was described as bentonite grout fluids and bentonite solids with drilled cuttings consistent with the bedrock lithology. After the initial cleanout, an obstruction in the borehole was measured at approximately 600 feet on 15 February 2015 and the well was cleaned out to total depth using the same drilling method. However, another obstruction was measured at approximately 620 feet after the second cleanout. On 16 February 2015, NEWP changed to the conventional direct air-rotary drilling method to clean out the borehole using stiff foam drilling fluid; however, the obstruction was measured at approximately 608 feet after cleanout activities. On 17 February 2015, the rig was converted to drill by the dual-tube reverse air-rotary method and bentonite-based drilling fluid was used to stabilize the borehole to total depth during cleanout. After removing the bit, the borehole was open past the previous obstructions and installation of the liner commenced.

A 6-inch nominal diameter PVC liner (schedule 40 wall thickness) was installed on 17 February 2015 to a depth of approximately 699 feet. The design of the liner included screened intervals (0.100 inch-wide horizontal perforations) from approximately 379 to 599 feet and from 639 to 699 feet with a PVC bottom cap. A blank interval of casing was installed between approximately 599 and 639 feet as an optional pump gallery to protect pump equipment due to potential fill re-entering the borehole. An as-built diagram for NSH-010 is included as Figure 6.

### 2.4.5 Well Development

After drilling to the total depth, the borehole was developed by airlift for approximately 3 hours with the bit at the bottom of the borehole on 3 November 2014. The concentration of solids in the discharge generally increased over the development period from approximately 30 to 120 ml/L, with the high concentration of 200 ml/L. The solids appeared consistent with the lithology of the bedrock drilled cuttings. After airlift development, the water level was observed to slowly recover from approximately 579 feet to approximately 558 feet on 4 November 2014.

Well development included installation of a submersible pump (Grundfos model 40S100-30) to approximately 675 feet on 5 March 2015. The water level prior to development was 552 feet and the initial discharge was bentonite-based drilling fluid. Water was added to the well to thin the fluids while pumping. Development also included several pumping and recovery periods. At the end of the day, the pumping water level was approximately 655 feet at a discharge rate of approximately 1 gpm. On 6 March 2015, the static water level was approximately 567 feet prior to development activities which included pumping and recovery periods. Generally, pumping water levels were approximately 655 feet after 30 minutes of pumping and the discharge rate had reduced from approximately 5 gpm to less than 1 gpm over the pumping period. The discharge was clear and free of sand at the end of the development period.

Additional development was conducted at NSH-010 using chemical dispersants on 16 April 2015. NEWP added approximately 1.75 gallons of chemical dispersant (AquaClear PFD manufactured by Baroid) to the well, then added approximately 200 gallons of water. The chemical dispersant was distributed in the well by swabbing; after swabbing, the well was pumped at 4 gpm for 6 hours. Field forms documenting well development are included in Appendix C.

## **2.5 WELL NSH-011**

Well NSH-011 was primarily sited for the purpose of identifying alluvial lithology and the depth to bedrock east of the mineralized area. The secondary purpose of NSH-011 was the installation of an alluvial piezometer to monitor water levels in this region. Well NSH-011 was planned for completion at a depth of 720 feet. Excelsior provided oversight for the drilling and installation of NSH-011 which was drilled to a depth of 602 feet. Based on Excelsior records, bedrock was encountered at approximately 545 feet and NSH-011 was completed as a nominal 2-inch piezometer to a total depth of 540 feet with a screened interval from 500 to 540 feet.

Geophysical logging was conducted by IDS-Colog on 4 November 2014 prior to installation of the well and included the following logs:

- Caliper/Gamma/Temperature/Conductivity;
- Electrical Resistivity; and
- Sonic.

The well was developed by the bailer method by Haley & Aldrich staff on 29 and 30 April 2015. Depth to water prior to development was approximately 494 feet. A total of approximately 24 gallons was purged from the well. Field forms documenting well development are included in Appendix C.

Copies of the geophysical logs are included in Appendix D.

## **2.6 WELL NSH-012**

Well NSH-012 was sited at location NSH-CU for the purpose of characterizing groundwater conditions in the alluvium in the northeastern area of the North Star Deposit.

Well NSH-012 is a 4-inch cased well with a planned depth of 445 feet; the well was drilled by NEWP using the 50k drilling rig and the air rotary method.

### 2.6.1 Borehole Drilling and Well Installation

Drilling activities for well NSH-012 commenced on 3 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 9 November 2014 using a 10-inch diameter air-rotary hammer bit to 504 feet. Installation of well NSH-012 was conducted on 10 November 2014 after geophysical logging was completed. The well included 4-inch nominal diameter LCS blank casing installed to 430 feet and the screened interval extended from 430 to 490 feet. Filter pack was installed from the bottom of the borehole to 422 feet, transition sand was installed to 409 feet, and high-solids bentonite grout was installed to land surface.

The top of the high-solids bentonite grout had dropped to approximately 220 feet by 20 November 2014. To complete the well, bentonite chips and high-solids bentonite grout were installed to land surface.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 7, and construction details are summarized in Table I.

### 2.6.2 Geophysical Logging

A geophysical logging survey was conducted by IDS-Colog at well NSH-0012 on 10 November 2014 and included the following logs:

- Caliper/Gamma.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.6.3 Lithology

The alluvium consists of primarily sand and gravel from land surface to approximately 502 feet overlying the Escabrosa Formation; the total depth of the borehole was 504 feet. Penetration rates in the alluvium were generally between approximately 0.3 and 2.0 minutes per foot. No water was observed during drilling activities. A detailed lithologic log is included in Appendix A.

### 2.6.4 Well Development

Development of well NSH-012 was conducted by NEWP and included bailing. Approximately 2 gallons of fluid was bailed from the well on 22 December 2014. No groundwater was observed in the well. The observations made at this location indicate that the water observed at higher elevations in nearby wells is likely fed by a deeper source of groundwater with a higher piezometric head. Field forms documenting well development are included in Appendix C.

## 2.7 WELL NSH-013

Well NSH-013 was sited at location NSH-BW to expand the existing cluster of wells (NSH-003 and NSH-006) located in the structural block between the Mojave #1, Patagonia, Atacama, and Forty Mile faults. Well NSH-013 was planned as an upper oxide bedrock test well and was expected to intercept the Mojave #1 fault.

NSH-013 is an open borehole interval well with a planned depth of 1,135 feet, and was drilled by NEWP using the 50k drilling rig and the air-rotary method.

### 2.7.1 Drilling and Casing Installation

Drilling activities for well NSH-013 commenced on 4 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 4 November 2014 using a 13-inch diameter air-rotary hammer bit to 650 feet. The 8-inch nominal diameter LCS intermediate casing was installed to approximately 646 feet on 5 November 2014. Neat cement grout was installed from approximately 597 to 646 feet and high-solids bentonite grout was installed to land surface. The casing installation was completed on 6 November 2014.

Bedrock drilling commenced on 7 November 2014. The borehole was drilled with a 7 $\frac{1}{8}$ -inch hammer bit to a total depth of approximately 1,070 feet, and was completed on 7 November 2014.

On 13 December 2014, the level of the cement in the annulus was observed to have dropped to approximately 75 feet. The annulus was filled with  $\frac{3}{8}$ -inch bentonite chips to approximately 67 feet and Tacna gravel was installed to surface.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 8, and construction details are summarized in Table I.

### 2.7.2 Geophysical Logging

A geophysical survey of the open borehole interval of well NSH-013 was conducted by IDS-Colog from 7 to 8 November 2014. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Sonic,
- Electrical Resistivity,
- Acoustic Borehole Televiwer,
- Gamma-Gamma Density, and
- Neutron.

After completion of the initial set of geophysical logs, equipment was set up for flow testing of the borehole. Ambient flow meter testing was performed using a corehole dynamic flow-meter (CDFM) tool. Injection was started at approximately 9 gpm and continued for approximately 3 hours. The well

was then allowed to recover for approximately 1.5 hours. The flow logging survey included the following logs:

- CDFM Ambient, and
- CDFM Injection (9.55 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.7.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 600 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 1.2 minutes per foot. The alluvium consists of gravel with clay and sand from land surface to approximately 600 feet. The upper portion of alluvium (to approximately 290 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lithology of the lower alluvium is primarily granitic. During drilling of the borehole for the intermediate casing, there was no evidence of saturation in the alluvium.

The Martin Formation was penetrated from 600 to 800 feet overlying an interval of the Escabrosa Formation to approximately 840 feet. The Martin Formation was observed again from approximately 840 to 950 feet overlying an interval of the Texas Canyon quartz monzonite from approximately 950 to 1,000 feet. The Martin Formation was observed again from approximately 1,000 to 1,070 feet and included a short interval of the Texas Canyon quartz monzonite from 1,050 to 1,060 feet. Penetration rates in the bedrock were relatively consistent between approximately 1.0 and 1.8 minutes per foot. Well NSH-013 intercepted the Mojave #1 fault at approximately 840 to 850 feet. A detailed lithologic log is included in Appendix A.

### 2.7.4 Well Development

After drilling to the total depth, the borehole was briefly developed by airlift with the bit approximately 20 feet off the bottom of the borehole on 7 November 2014. The amount of solids in the discharge was minor, and decreased over each development cycle from approximately 1.9 ml/L to less than 0.1 ml/L.

On 12 January 2015, NEWP installed a submersible pump (Grundfos, model 40S 100-30) to approximately 747 feet. The well was initially purged at approximately 20 gpm for approximately 2 hours resulting in a drawdown of approximately 90 feet. Following the initial purge, the well was repeatedly pumped and allowed to recover. The well was developed by pumping for a total of approximately 3 hours on 12 January 2015. At the end of the pumping, the discharge was generally clear with trace solids; however, additional pump development with a larger pump was recommended to Excelsior.

On 22 February 2013, additional pump development was conducted with a larger pump (Grundfos, model 85S 200-18) installed to approximately 869 feet. Pump development consisted of pumping at approximately 20 gpm; recovery for 15 minutes; pumping at 30 gpm for 45 minutes; recovery for 15 minutes; pumping at 40 gpm for 45 minutes; recovery for 15 minutes; and pumping at 40 gpm again for 45 minutes. The total drawdown at the end of the pumping was approximately 201 feet. Field forms documenting well development are included in Appendix C.



## **2.8 WELL NSH-014**

Well NSH-014 was sited at location NSH-DN to characterizing the interior of the structural block located between the Gibson, Chihuahua, and Patagonia faults, and was planned for completion in the sulfide zone below the oxide bedrock. The initial borehole for well NSH-014 was abandoned due to equipment failure and replaced by well NSH-014B at approximately the same location.

NEWP used the 685 drilling rig for drilling and well installation activities.

### **2.8.1 Borehole Drilling and Abandonment**

Drilling activities for NSH-014 commenced on 8 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling for NSH-014 continued on 8 November 2014 using a 10-inch diameter air-rotary hammer bit which penetrated the bottom of the alluvium at approximately 480 feet. The borehole could not be advanced deeper than approximately 740 feet on 9 November 2014 and the tools were removed for inspection. The drill bit had separated from the hammer; NEWP attempted to remove the drill bit without success and abandoned the borehole on 10 November 2014. The borehole for NSH-014 was abandoned by the installation of high-solids bentonite grout and neat cement by NEWP on 10 November 2014 as directed by Excelsior.

### **2.8.2 Lithology**

Penetration rates in the alluvium were generally between approximately 0.3 and 0.6 minutes per foot. The alluvium consists of clay with gravel and sand from land surface to approximately 50 feet overlying gravel with sand to approximately 480 feet. The alluvial lithology is primarily comprised of clasts consistent with the Texas Canyon quartz monzonite; non-granitic alluvial clasts include primarily sedimentary and metamorphic rocks.

Borehole drilling continued and the Martin Formation was fully penetrated from approximately 490 to 645 feet. Drilled cuttings from the Escabrosa Formation include gray dolomite and limestone with magnetite-bearing tactite and include copper and iron oxide minerals. The Upper Abrigo Formation was encountered at approximately 645 feet, appeared green to white in color, and included concentrations of copper and iron oxide minerals. Penetration rates in the Escabrosa and Martin formations were generally between approximately 0.7 and 1.7 minutes per foot and no evidence of groundwater was observed during drilling.

## **2.9 WELL NSH-014B**

Well NSH-014B was sited adjacent to the abandoned NSH-014 as a replacement for the lost hole and was drilled for the same purpose as Well NSH-014. NSH-014 is 4-inch cased well with a planned depth of 1,135 feet, and was drilled by NEWP using the 685 drilling rig and the air and mud-rotary methods.



### 2.9.1 Drilling and Well Installation

Drilling activities for well NSH-014B commenced on 10 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Drilling commenced with a 10-inch air rotary hammer bit on 10 November 2014; borehole instability observed on 12 November 2014 required the use of the mud rotary drilling method with 9 $\frac{7}{8}$ -inch tri-cone bit from approximately 1,002 feet to the target depth.

Installation of well NSH-014B was completed on 21 November 2014 after geophysical logging. The well included 4-inch nominal diameter LCS; blank casing installed to 1,180 feet and the screened interval extended from 1,180 to 1,260 feet. Filter pack was installed to approximately 1,170 feet, transition sand to approximately 1,160 feet, and high-solids bentonite grout was installed to land surface.

The top of the high-solids bentonite grout in the annulus was observed to have dropped to approximately 65 feet on 23 November 2014. A 5-foot interval of bentonite chips was installed to 60 feet and alternating layers of pea gravel, Tacna gravel and bentonite chips were installed to land surface.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 9, and construction details are summarized in Table I.

### 2.9.2 Geophysical Logging

A geophysical logging survey of the borehole for well NSH-014B was conducted by IDS-Colog on 11 November 2014. Prior to logging, the water level was measured at approximately 563 feet. The geophysical survey was completed 4 November 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity, and
- Sonic.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.9.3 Lithology

The alluvium lithology was the same as encountered in the adjacent NSH-014. The top of the Martin Formation was encountered at approximately 490 feet and included gray dolomite with magnetite-bearing tactite to approximately 645 feet. The Upper Abrigo, which included green amphibole-chlorite tactite/hornfels with iron oxide minerals, was encountered from 645 to 960 feet. Penetration rates in the Martin and Upper Abrigo formations were between approximately 0.9 and 1.9 minutes per foot.

Based on a change in lithology to a brown garnet-epidote tactite, the top of the Middle Abrigo Formation was interpreted at approximately 960 feet. The Lower Abrigo Formation, consisting of primarily black-colored hornfels with abundant quartz veins and minor to moderate amounts of iron

oxides, was encountered at 1,000 feet. Due primarily to the change in the drilling method at 1,000 feet, penetration rates decreased (compared to the Upper Abrigo Formation) to between approximately 3 and 48 minutes per foot to a total depth of approximately 1,277 feet on 19 November 2014. A detailed lithology log is included in Appendix A.

#### **2.9.4 Well Development**

After installation of well NSH-014B, the heavy mud in the borehole was purged by NEWP by airlift and a dispersant (Baroid AquaClear PFD) was added to the well to break down the remaining drilling fluids. Additional airlift development was conducted by BJ Drilling between 9 January 2015 and 12 January 2015; the airline was installed to approximately 1,100 feet and the well was purged to the bottom of the airline followed by slow recovery. Field forms documenting well development are included in Appendix C.

#### **2.10 WELL NSH-015**

Well NSH-015 was sited at location NSH-CJ to characterize the Black Rock fault, a significant north-south trending structural feature that is otherwise poorly constrained on-site. Well NSH-015 was planned for completion in the upper bedrock with the intention of penetrating the Black Rock fault at a depth of approximately 600 feet.

NSH-015 was planned and completed as an open borehole well design with a planned depth of 817 feet, and was drilled by NEWP using the 50k drilling rig and the air-rotary method.

##### **2.10.1 Drilling and Casing Installation**

Drilling activities for well NSH-015 commenced on 11 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch outside diameter (0.25-inch wall thickness) was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 12 November 2014 using a 12-inch diameter air-rotary hammer bit to approximately 585 feet. The intermediate 8 $\frac{1}{8}$ -inch outside diameter LCS casing (0.25-inch wall thickness) was installed to approximately 585 feet on 13 November 2014. After the casing was installed, neat cement grout was installed from approximately 514 feet to 577 feet, and high-solids bentonite grout was installed from 514 feet to land surface. The casing installation was completed on 14 November 2014.

Drilling of the 7 $\frac{1}{8}$ -inch borehole into bedrock commenced on 14 November 2014 and was drilled to a total depth of approximately 820 feet.

On 24 November 2014, the level of the bentonite grout in the annulus was observed to have dropped to approximately 85 feet. Bentonite chips were installed to 82 feet and  $\frac{3}{8}$ -inch pea gravel was installed to land surface.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 10, and construction details are summarized in Table I.

### 2.10.2 Geophysical Logging

Geophysical logging of the open borehole interval of well NSH-015 was conducted by IDS-Colog on 15 November 2014. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Sonic,
- Electrical Resistivity,
- Acoustic Borehole Televiwer,
- Gamma-Gamma Density, and
- Neutron.

After completion of the initial set of geophysical logs, equipment was set up on site for flow testing. Ambient flow-meter testing was performed with a spinner flow meter tool. Injection started at approximately 7.4 gpm and was increased up to 11 gpm. The water level could only be raised approximately 2.7 feet. Flow logging was postponed so that a higher capacity pump could be used to increase the rate of injection. On 21 November 2014, dynamic flow logging resumed with an injection rate goal of 50 gpm. Four runs using the spinner tool were conducted with injection rates ranging from 36 gpm to 40 gpm.

- CDFM: Ambient, and
- Spinner: Injection (40 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of geophysical logs are included in Appendix D.

### 2.10.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 370 feet. Penetration rates in the alluvium were between approximately 0.4 and 1.3 minutes per foot. The alluvium consists of sand with gravel from land surface to approximately 370 feet. The upper portion of alluvium (to approximately 240 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lithology of the lower alluvium is primarily granitic.

The Texas Canyon quartz monzonite was encountered underlying the alluvium at approximately 370 feet and extended to approximately 800 feet. Below the Texas Canyon quartz monzonite, the Middle Abrigo Formation extended to the total borehole depth of 820 feet. Penetration rates in the bedrock ranged between approximately 0.8 to 2.2 minutes per foot. A detailed lithologic log is included in Appendix A.

The Black Rock fault was not intersected in the NSH-015 borehole and subsequent review of the geologic model indicates that the anticipated location of the fault plane may be offset east of the NSH-015, NSH-016, NSH-017 cluster.

#### 2.10.4 Well Development

Pump development was conducted at NSH-015 on 10 January 2014. NEWP installed a submersible pump (Grundfos, model 40S 100-30) to approximately 653 feet. The well was initially purged at approximately 30 gpm for approximately 2.5 hours. The pump was shut off and the well was allowed to recover for approximately 10 minutes. The pump was turned on for a second time and allowed to pump for 10 more minutes. On 13 February 2013, 4 hours of airlift development was conducted by BJ Drilling primarily to evaluate borehole stability. Field forms documenting well development are included in Appendix C.

#### 2.11 WELL NSH-016

Well NSH-016 was sited at location NSH-CJ to characterize the porphyry quartz monzonite west of the Black Rock fault.

NSH-016 was planned and completed as an open borehole well design with a planned depth of 820 feet and was drilled by NEWP using the 50k drilling rig and the air-rotary method. Upon completion, a PVC liner was installed to stabilize the open interval; details are included in Section 2.11.4.

##### 2.11.1 Drilling and Casing Installation

Drilling activities for well NSH-016 commenced on 15 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch outside diameter (0.25-inch wall thickness) was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling was continued on 15 November 2014 using a 12¾-inch diameter air-rotary hammer bit to a depth of approximately 580 feet on 16 November 2014.

The intermediate 8⅝-inch outside diameter (0.25-inch wall thickness) LCS casing was installed to 580 feet on 16 November 2014. Prior to installation of the casing, bentonite chips were installed in the borehole from approximately 571 to 580 feet. Neat cement grout was installed in the annulus from 523 to 571 feet, and high-solids bentonite grout was installed from approximately 523 feet to land surface.

Bedrock borehole drilling commenced on 18 November 2014 using a 7⅝-inch air-rotary hammer bit; the borehole was completed to a depth of 820 feet on 19 November 2014.

On 24 November 2014, the level of the cement-bentonite grout in the annulus was observed to have dropped to approximately 90 feet. The annulus was filled with ⅜-inch bentonite chips to approximately 4 feet and ¾-inch pea gravel was installed to surface.

Well completion field forms are included in Appendix B, an as-built well diagram is included as Figure 11, and construction details are summarized in Table I.

##### 2.11.2 Geophysical Logging

Geophysical logging of the open borehole interval at well NSH-016 was conducted by IDS-Colog and started 19 November 2014. The total depth reached by logging tools was 815 feet. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,

- Sonic,
- Electrical Resistivity,
- Acoustic Borehole Televiwer, and
- CDFM Ambient.

After completion of the initial geophysical logging, equipment was set up on site for flow testing. Ambient flow meter testing was performed with a CDFM tool; dynamic flow testing was performed using a spinner tool. Injection was started at approximately 80 gpm for dynamic flow logging with spinner tool. The spinner tool was not functioning correctly and dynamic flow logging was on hold till 21 November 2015. When dynamic flow logging commenced, the tooling was unable to get past 694 feet due to a blockage and dynamic flow logging was not completed.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.11.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 400 feet. Penetration rates in the alluvium were between approximately 0.5 and 1 minute per foot, but rates as slow as 1.4 minutes per foot were observed over short intervals. The alluvium consists of clayey sand from land surface to approximately 30 feet, sand with gravel from 30 feet to 260 feet, and sand 260 feet to 400 feet. There was no evidence of saturation in the alluvium.

The Texas Canyon quartz monzonite was encountered underlying the alluvium and was the only formation encountered. Penetration rates in bedrock were between approximately 0.8 and 2.0 minutes per foot to a total depth of approximately 820 feet in the Texas Canyon quartz monzonite. Although groundwater was observed during drilling, the water level was difficult to estimate due to the drilling method. The discharge rate of groundwater was not observed to increase significantly with depth. A detailed lithologic log is included in Appendix A.

### 2.11.4 Borehole Cleanout and Liner Installation

On 18 February 2015, NEWP mobilized to well NSH-016 with the 50k drilling rig and used several methods to clean out the borehole which had an obstruction at 690 feet. During cleanout, the obstruction material appeared consistent with the lithology of the drilled cuttings from the Texas Canyon quartz monzonite, small porphyry gravels. Borehole was cleaned down to the original total depth of 820 feet.

After NEWP tripped all tooling out of the borehole, IDS-Colog ran a caliper log of the borehole and the bottom of the borehole was tagged at 810 feet with caliper tool. During installation of the PVC liner, the borehole had collapsed and the liner could not be installed past 710 feet. On 19 February 2015, the liner installation was completed. The design of the liner included screened intervals (0.100 inch-wide horizontal perforations) from approximately 301 to 601 feet and from 641 to 701 feet, with a bottom cap at approximately 701 feet. The blank interval of casing was installed between approximately 601 and 641 feet as an optional pump gallery due to potential fill re-entering the borehole. The well as-built diagram for NSH-016 is included as Figure 11.

### 2.11.5 Well Development

Pump development was conducted on 11 January 2015. Prior to pumping, the static water level was approximately 601 feet. The maximum pumping rate was approximately 34 gpm with a total drawdown of approximately 7 feet.

Airlift development was conducted on 23 January 2015 primarily to test the stability of the open borehole interval. With the airline installed to approximately 740 feet, discharge reached a rate of approximately 30 gpm with the returned sample consisting of approximately half sand and half gravel. Airline was raised to 680 feet with discharge rates reaching 10 gpm. Field forms documenting well development are included in Appendix C.

## 2.12 WELL NSH-017

Well NSH-017 was sited at location NSH-CK to characterize the interior of the structural block and the metasedimentary rocks between the Black Rock and Sonora faults, south of the Atacama fault. NSH-017 is a 6-inch cased well design with a planned depth of 1,230 feet, and was drilled by NEWP using the 50k drilling rig and the air-rotary method.

### 2.12.1 Borehole Drilling and Well Installation

Drilling activities for well NSH-017 commenced on 19 November 2014. A 20-inch diameter borehole was drilled to a depth of 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed to land surface.

Borehole drilling continued on 20 November 2014 using a 12-inch diameter air-rotary hammer bit which was replaced by an 11 $\frac{3}{8}$ -inch tri-cone bit at 930 feet due to excessive water production.

Installation of well NSH-017 commenced on 5 December 2014 after geophysical logging was completed in the borehole. The well construction materials consisted of 6-inch nominal diameter LCS; blank casing was installed to 940 feet and the screened interval extended from 940 to 1,181 feet. Filter pack was installed to 930 feet, transition sand was installed to 919 feet, and high-solids bentonite grout was installed to 382 feet. Above the high-solids bentonite grout, 22 feet of bentonite chips were installed, and Tacna gravel and  $\frac{3}{8}$ -inch pea gravel were installed to land surface.

### 2.12.2 Geophysical Logging

Geophysical logging was conducted in the borehole of well NSH-017 by IDS-Colog and commenced on 3 December 2014. The geophysical survey was completed 4 December 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic,
- Acoustic Borehole Televiwer,
- Optical Borehole Televiwer,
- CDFM: Ambient, and
- CDFM: Injection (average rates per survey were between approximately 74 to 78 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.12.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 420 feet. Penetration rates in the alluvium were generally between approximately 0.6 and 1.8 minutes per foot. The alluvium consists of clayey sand with gravel from land surface to approximately 20 feet bls overlying sand with gravel to approximately 420 feet. The upper portion of alluvium (from approximately 20 to 250 feet) is comprised of approximately 50 to 60 percent granitic clasts and approximately 40 to 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit (below approximately 250 feet) is comprised of approximately 95 percent granitic clasts and approximately 5 percent non-granitic clasts.

The Texas Canyon quartz monzonite was encountered underlying the alluvium at approximately 420 feet. From the alluvium contact to 1,030 feet, the formations alternate between the Middle Abrigo Formation and dikes of the Texas Canyon quartz monzonite. The Texas Canyon quartz monzonite is present between 460 feet and 550 feet, 630 feet and 720 feet, 740 feet and 760 feet, and sporadically between 780 feet and 830 feet. The Middle Abrigo Formation is present between 550 feet and 630 feet, 720 feet and 740 feet, 760 feet and 780 feet, sporadically between 780 feet and 830 feet, and 830 feet and 1030 feet. Penetration rates in the Texas Canyon quartz monzonite were generally between approximately 2.1 and 5.4 minutes per foot, and within the Middle Abrigo Formation between 1.4 and 29.4 minutes per foot. From 1,030 to 1,200 feet was the Lower Abrigo Formation, which had penetration rates between approximately 1.3 and 13.2 minutes per foot.

Well NSH-017 appears to have intersected the Black Rock fault at a depth of 515 feet based on interpretation of Optical Borehole Image (OBI) data. The borehole encountered significant water production at a depth of 790 feet. The borehole was terminated at a depth of 1,200 feet based on mineralogical observations made by Excelsior. An unanticipated structure that is sub-parallel to the bedding plane dip was encountered at a depth of 1,000 feet based on interpretation of Acoustic Borehole Imaging (ABI) data. A detailed lithology log is included in Appendix A.

The occurrence of groundwater during drilling was first noted in the 760- to 780-foot interval; no makeup water was being used and approximately 50 gpm of water discharged with the drilled cuttings. The penetration rate in this interval was approximately 3.9 minutes per foot. At 920 feet, groundwater production increased to an estimated 250 gpm and continued to increase to approximately 300 gpm.

### 2.12.4 Well Development

Development of Well NSH-017 was conducted 7 January 2015 using the Grundfos 40S 100-30 pump. The development consisted of pumping the well using approximately 30-minute pumping intervals with a 20-minute surge period between pumping. On 7 January 2015, with the pump set at approximately 926 feet, the pumping rates were increased from 5 gpm to the maximum pumping capacity of 30 gpm. The pump was raised to approximately 713 feet, and was pumped and surged repeatedly for a duration of 25 minutes at maximum capacity of 32 gpm with a 45 minute recovery. Pumping continued for approximately three hours at rates between approximately 10 and 32 gpm.



On 27 January 2015, NSH-017 was developed again using the Grundfos 85S 200-30. With the pump installed to approximately 931 feet, the well was pumped at approximately 80 gpm for 3.75 hours; maximum drawdown during development was approximately 64 feet. At the beginning of the development period, the water included 0.1 ml/L of sand with turbid water (182 nephelometric turbidity units [NTU]). At the end of the development period, the discharge was clear and free of sand. Field forms documenting well development are included in Appendix C.

### **2.13 WELL NSH-018**

Well NSH-018 was sited at location NSH-CV to characterize the lower oxide bedrock zone to the east of the planned in-situ recovery area. Well NSH-018 was not planned to intersect any significant structures.

NSH-018 is a 4-inch cased-hole design with a planned depth of 1,565 feet and was drilled by NEWP using the 685 drilling rig and the air-rotary method.

#### **2.13.1 Borehole Drilling and Well Installation**

Drilling activities for well NSH-018 commenced on 23 November 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 24 November 2014 using a 10-inch diameter air-rotary hammer bit and was drilled to 960 feet before the bit was changed to 9 $\frac{1}{8}$ -inch tri-cone due to water production. The borehole was drilled to a total depth of 997 feet.

Installation of well NSH-018 commenced on 7 December 2014 after geophysical logging was completed. The well included 4-inch nominal diameter LCS; blank casing was installed to 610 feet and the screened interval extended from 610 to 992 feet. The filter pack was installed from total depth of the borehole to 599 feet, transition sand was installed to 589 feet, bentonite chips were installed to 564 feet, and formation stabilizer consisting of  $\frac{3}{8}$ -inch pea gravel and Tacna gravel was installed to land surface.

#### **2.13.2 Geophysical Logging**

Geophysical logging was completed in the borehole of well NSH-018 by IDS-Colog and commenced on 6 December 2014. The geophysical survey was completed 6 December 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic, and
- Acoustic Borehole Televiwer (two files: initial analysis and after additional processing).

Flow logging was conducted by IDS-Colog on 7 December 2014. The ambient flow meter testing was performed with a CDFM tool. Injection was started at approximately 50 gpm, but had to be increased to 70 gpm for dynamic flow testing with CDFM tool.

- CDFM: Ambient, and
- CDFM: Injection (average was approximately 68 gpm).



The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.13.3 Lithology

The borehole penetrated the bottom of the alluvium at approximately 420 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 1.0 minute per foot. The alluvium consists of silty sand with gravel from land surface to approximately 10 feet, overlying silty sand from 10 feet to 20 feet. Lean clay with sand from 20 feet to 30 feet, silty sand from 30 feet to 40 feet, and gravel with sand from 40 feet to 420 feet.

The Black Prince Formation was encountered underlying the alluvium at approximately 420 feet and continued to the total depth of borehole at 997 feet. The Black Prince Formation drilled at penetration rates ranging between approximately 2.1 and 5.4 minutes per foot until groundwater production increased to the point that it affected the drilling rate. The final penetration rate of the air-rotary hammer, from 910 feet to 960 feet, decreased to 30 minutes per foot. The occurrence of groundwater during drilling was first noted when drilling the 580- to 600-foot interval. At 910 feet, the driller reported hitting a fracture and groundwater production increased to an estimated 200 gpm, and varied between an estimated 200 gpm and 400 gpm depending on how much air pressure the driller was applying. The rate of groundwater production provided too much pressure for the hammer to work properly; the bit was changed to a 9 $\frac{1}{8}$ -inch tri-cone bit at 960 feet and was used to complete the borehole at 997 feet.

Well NSH-018 intersected apparent voids which produced a significant flow of water into the borehole. The borehole was terminated at a depth of 992 feet as a result of excessive water production and was re-classified as an upper oxide test well based on the revised depth. Well NSH-018 was completed at a depth of 992 feet, and is screened from 610 to 992 feet.

### 2.13.4 Well Development

Development of Well NSH-018 was conducted 20 to 21 December 2014. On 20 December 2014, the well was pumped at an estimated 38 gpm for 40 minutes, with the pump set at approximately 656 feet. On 21 December 2015, pump development resumed and consisted of 11 pump and surge cycles ranging in duration from 20 minutes to 5 minutes of pumping, with periods of recovery (generally 5 to 10 minutes), as dictated by well performance.

On 9 January 2015, NSH-018 was developed again using the Grundfos 40S 100-30. With the pump installed to approximately 700 feet, the well was pumped at approximately 20 gpm for 1 hour; the discharge contained less than 0.1 ml/L of sand and appeared slightly cloudy. The pumping rate was increased to 30 gpm for 2 hours, after which the rate was increased to the maximum pump capacity (approximately 35 gpm) for 1 hour. Maximum drawdown was approximately 6 feet and the sand content was less than 0.1 ml/L sand and clear at the end of the development period. Field forms documenting well development are included in Appendix C.

## 2.14 WELL NSH-019

Well NSH-019 was sited at location NSH-DA, which is one of two planned well locations intended to characterize the interior of the structural block located between the Sonora and Mojave #1 faults. Well NSH-021 is to be the second well in this pair. Well NSH-019 was planned to be completed in the oxide bedrock zone.

NSH-019 was designed and constructed as an open borehole well with a planned depth of 1,440 feet, and was drilled by NEWP using the 50k drilling rig and the air rotary method.

### 2.14.1 Drilling and Casing Installation

Drilling activities for well NSH-019 commenced on 7 December 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed to land surface.

Borehole drilling continued on 7 December 2014 using a 13-inch diameter air-rotary hammer bit to a depth of 638 feet. Installation of 8-inch nominal diameter intermediate casing commenced on 9 December 2014 and was installed to a depth of approximately 638 feet. Bentonite chips were installed from approximately 631 to 638 feet, neat cement grout was installed from 588 feet to 631 feet high-solids bentonite grout was installed from 588 feet to land surface. The casing installation was completed on 10 December 2014.

Bedrock drilling commenced on 10 December 2014. The borehole was drilled with a 7½-inch hammer bit to a depth of approximately 1,188 feet on 11 December 2014. Groundwater production rates were too high for the hammer bit to function properly and consequently the borehole was completed using a 7½-inch tri-cone bit on to a depth of 1,410 feet on 14 December 2014.

On 21 December 2014, the level of the cement in the annulus was observed to have dropped to approximately 65 feet. The annulus was filled with ¾-inch bentonite chips to approximately 51 feet and Tacna gravel was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-019 is included as Figure 14, and well construction details are summarized in Table I.

### 2.14.2 Geophysical Logging

A geophysical logging survey of the open bedrock interval of well NSH-019 was conducted by IDS-Colog from 14 to 15 December 2014. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Sonic,
- Acoustic Borehole Televiwer,
- Electrical Resistivity,
- Gamma-Gamma Density, and
- Neutron.

Flow logging was conducted by IDS-Colog on 17 December 2014. The ambient flow testing was performed with a CDFM tool and dynamic flow testing was performed with a spinner flow meter tool. Injection was started at approximately 80 gpm for dynamic flow testing with spinner tool. Six runs were completed at approximately 80 gpm injection rate. The flow logging survey included the following logs:

- CDFM: Ambient, and
- Spinner: Injection (80 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### **2.14.3 Lithology**

The bottom of the alluvium was encountered at approximately 550 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 1.2 minutes per foot. From land surface to approximately 40 feet, the alluvium consisted of silty sand with gravel. From 40 feet to 550 feet, the alluvium consisted of sand with gravel. During drilling of the borehole for the intermediate casing, no evidence of saturation in the alluvium was observed.

The Martin Formation was the first bedrock encountered at approximately 550 feet and continued to 710 feet. Penetration rates in the bedrock ranged from 0.8 minutes per foot to 9.3 minutes per foot when drilling with the hammer bit. When drilling changed to the tri-cone bit, penetration rates steadily decreased from 13.5 minutes per foot to 42.8 minutes per foot.

The geology encountered consisted of one repeating interval. The Martin Formation was penetrated from 550 feet to 710 feet, overlying an interval of the Upper Abrigo Formation to approximately 810 feet. The Martin Formation was observed again from approximately 810 to 850 feet overlying a sequence of the Abrigo Formations; Upper Abrigo Formation from 850 feet to 1,020 feet, Middle Abrigo Formation from 1,020 feet to 1,240 feet, and the Lower Abrigo Formation from 1,240 feet to 1,410 feet. Drilling was terminated at a depth of 1,410 feet based on mineralogical observations made by Excelsior. The open borehole interval of the well partially caved in prior to aquifer testing; the fill was measured at 1,300 feet.

### **2.14.4 Well Development**

NSH-019 was developed by airlift on 9 February 2015. The initial airlift development was conducted from approximately 900 feet for 35 minutes and discharge was approximately 55 gpm. At the end of the 35 minutes of development, sand content was less than 0.1 ml/L and the groundwater was clear. The well recharged for 30 minutes, after which airlift development was continued from a depth of 1,000 feet. Airlift development continued for 75 minutes at approximately 60 gpm; the final samples from development were clear and free of sand. Field forms documenting well development are included in Appendix C.

## 2.15 WELL NSH-020

Well NSH-020 was sited at location NSH-CX to characterize the upper oxide bedrock zone to the east of the planned in-situ recovery area. Few previous holes have been drilled in this area and geologic structure in this area is poorly constrained within the geologic model. Well NSH-020 was not planned to intersect any significant structures. Following completion of well NSH-018 as an upper oxide test well, Well NSH-020 was re-classified as a lower oxide test well.

NSH-020 is a 4-inch cased well with a planned depth of 1,075 feet; the well was drilled by NEWP using the 685 drilling rig and the air rotary method.

### 2.15.1 Drilling and Well Installation

Drilling activities for well NSH-020 commenced on 8 December 2014. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 9 December 2014 using a 10-inch diameter air-rotary hammer bit to a depth of 1,600 feet. Installation of well NSH-020 commenced on 17 December 2014 after geophysical logging was completed. The well was constructed using 4-inch nominal diameter LCS; blank casing was installed to 1,060 feet with three separate screened intervals below. The screened intervals were installed from 1,060 feet to 1,181 feet, 1,241 feet to 1,402 feet, and 1,472 feet to 1,582 feet with blank casing sections between the three screened intervals. The filter pack was installed from the top of the fill to 1,459 for the lower screen interval feet, from 1,406 feet to 1,227 feet for the middle screened interval, and from 1,202 feet to 1,050 feet for the upper screened interval. The three filter pack intervals were separated by bentonite seals. Transition sand was installed from 1,035 to 1,050 feet, and high-solids bentonite grout was installed to land surface.

On 21 December 2014, the level of grout in the annulus was observed to have dropped to approximately 340 feet. The annulus was filled with bentonite chips to 320 feet and Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-020 is included as Figure 15, and well construction details are summarized in Table I.

### 2.15.2 Geophysical Logging

A geophysical survey of the borehole at NSH-020 was conducted by IDS-Colog and commenced on 15 December 2014. The geophysical survey was completed 16 December 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic, and
- Acoustic Borehole Televiwer.

Flow logging was conducted by IDS-Colog on 16 December 2014. The ambient flow meter testing was performed with a CDFM tool. Injection was started at approximately 75 gpm but had to be increased to 150 gpm for dynamic flow testing with the CDFM tool. The flow logging survey included the following logs:

- CDFM: Ambient, and
- CDFM: Injection (average rate for each survey were between approximately 133 and 147 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.15.3 Lithology

The bottom of the alluvium was encountered at approximately 450 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 1.2 minutes per foot. The alluvium consists of sand with gravels, with the upper portion from land surface to 300 feet being comprised of mixed lithics containing approximately 50 percent granitic clasts from the Texas Canyon quartz monzonite and 50 percent non-granitic clasts sedimentary and metamorphic rocks. From 300 feet to 450 feet, the alluvium consists of primarily granitic alluvium, approximately 80 percent granitic clasts and 20 percent non-granitic clasts.

The Black Prince Formation was the first bedrock encountered at approximately 450 feet and continued to 1,170 feet. The penetration rates in the Black Prince Formation ranged between approximately 1.1 and 3.8 minutes per foot. The occurrence of groundwater during drilling was first noted at the 700 to 720 foot interval. At approximately 1,120 feet, groundwater production increased to an estimated 400 gpm (visual estimation) and varied between an estimated 200 gpm and 400 gpm depending on how much air pressure the driller applied. The rate of groundwater production provided too much pressure for the air-rotary hammer to work properly, and a 9 $\frac{1}{8}$ -inch tri-cone bit was used to complete the borehole from 1,130 feet. Underlying the Black Prince Formation, the Escabrosa Formation was encountered from 1,170 feet to 1,550 feet; the penetration rate ranged from 1.8 to 6.2 minutes per foot. The Martin Formation was penetrated from 1,550 feet, and to the total depth of the well at 1,600 feet; penetration rates ranged from 2.8 to 6.7 minutes per foot.

Well NSH-020 intersected apparent voids which produced a significant flow of water into the borehole. The hole was advanced to a depth of 1,600 feet based on the re-classification of this well; the three screened intervals in well NSH-020 are located between 1,050 and 1,582 feet, which are positioned opposite of three zones containing voids and structural features that were observed to contribute significant groundwater flow to the well. A detailed lithologic log is included in Appendix A.

### 2.15.4 Well Development

Pump development of Well NSH-020 was conducted on 8 January 2015. A Grundfos 40S 100-30 was installed to a depth of 700 feet. Initially, the well was purged at approximately 5 gpm; however the pump began having issues and was pumping intermittently; it was shut down completely to allow for recovery. When the pump was restarted at maximum capacity (approximately 35 gpm), no further issues were observed. Pumping at approximately 35 gpm continued for approximately 1.5 hours, followed by a 25-minute recovery period. Pumping continued for 1 hour at 32 gpm. The maximum drawdown was approximately 27 feet and the discharge at the end of the development period was free of sand and clear. Field forms documenting well development are included in Appendix C.

## 2.16 WELLS NSH-021 & NSH-021B

Well NSH-021 was sited at location NSH-DB as the second well of a two-well pair intended to characterize the interior of the structural block located between the Sonora and Mojave #1 faults. Well NSH-019 is the first well in this pair. Well NSH-021 was planned to be completed at a depth of 1,392 feet, in the oxide bedrock zone.

Incorrect surface casing was installed at Well NSH-021. No drilling occurred after the surface casing was set at this location. The surface casing at Well NSH-021 was capped and the rig moved over to Well NSH-021B. No further drilling is planned at Well NSH-021.

A drill bit was lost in bore hole NSH-021B at a depth of 1,250 feet. Fishing was stopped and NSH-021B was abandoned using cement-bentonite grout from total depth to surface on 9 January 2015. Lithologic observations made drilling of NSH-021B are reported under the heading NSH-021C.

## 2.17 WELL NSH-021C

Well NSH-021C was sited adjacent to the NSH-DB hole as a replacement location for NSH-021B. NSH-021C was designed and completed as an open borehole well with a planned depth of 1,392 feet. The well was drilled by NEWP using a 50k drilling rig and the air rotary method.

### 2.17.1 Drilling and Casing Installation

Drilling activities for well NSH-021C commenced on 10 January 2015. A 20-inch borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed to land surface.

Borehole drilling continued on 10 January 2015 using a 13-inch diameter air-rotary hammer bit to a depth of 624 feet. The intermediate casing, consisting of 8-inch nominal diameter LCS casing, was installed on 11 January 2015 to approximately 624 feet. Neat cement grout was installed from approximately 562 to 624 feet, and high-solids bentonite grout was installed to land surface on 12 January 2015.

Drilling of bedrock commenced with a 7½-inch diameter hammer bit. On 13 January 2015, large volumes of water in the borehole flooded the hammer bit. A 7½-inch tri-cone bit was used to drill the remainder of the borehole from approximately 1,160 feet, reaching a total depth of 1,400 feet on 14 January 2015.

On 8 February 2015, the level of the grout in the annulus was observed to have dropped to approximately 313 feet. A 5-foot thick interval of ¾-inch bentonite chips was installed and Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-021C is included as Figure 16, and well construction details are summarized in Table I.

### 2.17.2 Geophysical Logging

A geophysical logging survey open borehole interval of well NSH-021C was conducted by IDS-Colog on 20 February 2015. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,

- Sonic,
- Acoustic Borehole Televiewer, and
- Electrical Resistivity.

Flow testing was conducted at NSH-021C on 20 February 2015. Ambient flow testing was performed with a CDFM tool and dynamic flow testing was performed with a spinner flow meter tool. Injection was started at approximately 80 gpm for dynamic flow testing with the spinner tool. Injection continued for approximately 6 hours, with an injection rate varying from approximately 70 to 80 gpm. During the injection, eight spinner logs were run at approximately 40 feet per minute. The well was then allowed to recover for approximately 1 hour. The flow logging survey included the following logs:

- CDFM: Ambient, and
- Spinner: Injection (line speed was approximately 40 feet/min; average injection rate was 70.5 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.17.3 Lithology

The bottom of the alluvium was encountered at approximately 540 feet. Penetration rates in the alluvium were generally between approximately 0.3 and 1.0 minute per foot. The upper portion of alluvium (to approximately 290 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily carbonate rocks. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts. During drilling of the borehole for intermediate casing, there was no evidence of saturation in the alluvium.

The Martin Formation was the first bedrock encountered at approximately 540 feet, continuing to 620 feet and contained chrysocolla from approximately 590 to 620 feet. The interval from approximately 620 to 640 feet is a transition zone between the Martin and Upper Abrigo formations. The Upper Abrigo Formation was penetrated completely from approximately 640 to 1,020 feet, and contained chrysocolla between 640 to 670 feet and between 750 to 830 feet. The Middle Abrigo Formation was penetrated completely from approximately 1,020 to 1,250 feet and contained copper mineralization from 1,070 to 1,080 feet and 1,140 to 1,150 feet. The Lower Abrigo was encountered from approximately 1,250 feet to the total depth of 1,400 feet, and contained a lens of iron oxide between 1,370 to 1,380 feet. Penetration rates in the Martin and Abrigo formations varied from approximately 0.8 to 6.8 minutes per foot.

Moderate fracturing was noted throughout the well. ABI interpretation shows significant fracture zone from 750 to 775 feet (geologic model estimates placed the zone approximately 50 to 100 feet higher); orientation of fracturing correlates to a reverse fault indicated in the geologic model. A detailed lithologic log is included in Appendix A.



#### 2.17.4 Well Development

Airlift development was conducted by BJ Drilling. On 30 January 2015, BJ Drilling installed an airline to approximately 800 feet and started airlifting at approximately 25 gpm. The well was airlifted and allowed to recover repeatedly at approximate rates of 25, 35, and 75 gpm. Initially the discharge was cloudy to turbid and brown, with variable sand content of approximately 0.4 ml/L. By the end of the airlift development, the discharge was clear and the sand content had decreased. Field forms documenting well development are included in Appendix C.

#### 2.18 WELL NSH-022

Well NSH-022 was sited for the purpose of characterizing the interior of the structural block located between the Forty Mile, Great Sandy, and Atacama faults. Well NSH-022 is planned for completion as a lower oxide test well. No major structures were planned to be intersected by well NSH-022. The planned depth of well NSH-022 was 1,408 feet; the well was drilled by NEWP using the 685 drilling rig, and the air rotary method.

##### 2.18.1 Drilling and Well Installation

Drilling activities for well NSH-022 commenced on 20 December 2014. A 20-inch borehole was drilled to 20 feet, LCS surface casing with a 14-inch outside diameter (0.25-inch wall thickness) was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 21 December 2014 using a 12-inch diameter air-rotary hammer bit. Rough drilling conditions destroyed the hammer bit which was not advanced deeper than 660 feet. Drilling continued with 11 $\frac{1}{8}$ -inch and 11 $\frac{3}{8}$ -inch tri-cone bits to a depth of 1,170 feet. The borehole was drilled by the air rotary method to approximately 1,020 feet; however, the mud rotary method was used to complete borehole drilling due to formation instability. Installation of well NSH-022 commenced on 16 January 2015 after geophysical logging was completed. The well included 6-inch nominal diameter LCS; blank casing was installed to approximately 1,010 feet and the screened interval extended from 1,010 to 1,131 feet. Filter pack was installed from the bottom of the borehole to approximately 997 feet, transition sand was installed to approximately 972 feet, and high-solids bentonite grout was installed to land surface on 19 January 2015.

On 2 February 2015, the level of the cement in the annulus was observed to have dropped to approximately 209 feet. A 5-foot thick interval of  $\frac{3}{8}$ -inch bentonite chips was installed in the annulus and Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-022 is included as Figure 17, and well construction details are summarized in Table I.

##### 2.18.2 Geophysical Logging

A geophysical logging survey of the borehole for well NSH-022 was conducted by IDS-Colog and commenced on 15 January 2015 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,



- Sonic, and
- Acoustic Borehole Televiewer.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Copies of the geophysical logs are included in Appendix D.

### 2.18.3 Lithology

The bottom of the alluvium was encountered at approximately 600 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 1.9 minutes per foot. The alluvium consists of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts to approximately 320 feet. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit (from approximately 320 to 600 feet) is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts.

The Escabrosa Formation was the first bedrock encountered at approximately 600 feet, continuing to 720 feet, and included coarse grained marble. Penetration rates in the Escabrosa Formation were generally between approximately 2 and 18 minutes per foot; no evidence of groundwater was observed during drilling. An 11 $\frac{7}{8}$ -inch tri-cone bit was used from approximately 660 feet to total depth due to borehole stability issues.

The top of the Martin Formation was encountered at approximately 720 feet and included altered carbonates and highly mineralized zones from approximately 730 to 770 feet and from approximately 930 to 960 feet. Penetration rates in the Martin Formation were between approximately 2 and 32 minutes per foot and an additional tri-cone bit was required (11 $\frac{7}{8}$ -inch diameter). The Abrigo Formation was penetrated at approximately 1,000 feet and penetration rates in the formation were between approximately 4 and 48 minutes per foot to the total depth of the borehole, at approximately 1,170 feet. A detailed lithologic log is included in Appendix A.

ABI interpretations reveal moderate fracturing from 600 to 1,000 feet, representing a north-northwest striking and southwest dipping fault (which is in opposite of the typical trend). Intense fracturing was observed from 1,000 to 1,030 feet, which roughly mirrors bedding planes and correlates well with the geologic model.

### 2.18.4 Well Development

Development of well NSH-022 included airlift and pump activities conducted by NEWP. After installation of the well, tremie pipe was installed as an airline to airlift develop the well with the drilling rig. The well was developed by airlift for a total of approximately 6 hours on 20 and 21 January 2015; the airline was initially installed to approximately 600 feet and was worked down to approximately 1,000 feet by the end of the development period. The discharge rate was approximately 1 to 2 gpm and was turbid with trace sand. The sand content, turbidity, and discharge rate did not appear to change during the development period.

Further development was conducted by NEWP using a pump rig. From 22 to 25 January 2015, the well was developed by swab and bail and pump activities. A tightly fitting swab tool was reciprocated through the screened interval for approximately four total hours on 23 and 24 January 2015 to work in

dispersant (Baroid AquaClear PFD). During pumping, the discharge rate would decrease to approximately 1 gpm at a pumping water level at approximately 865 feet. By the end of the development period, the turbidity of the discharge decreased significantly and appeared cloudy to clear. Field forms documenting well development are included in Appendix C.

## **2.19 WELL NSH-023**

Well NSH-023 was sited at location NSH-DD as the second well of a two-well pair intended to characterize the interior of the structural block located between the Forty Mile and Mojave #1 faults. Well NSH-024 is the other well in this pair. Push-pull pumping and extraction tests were to be conducted using these two wells. Completion was planned in the oxide bedrock zone. The well design was an open borehole with a planned depth of 1,446 feet. NSH-023 was drilled by NEWP using a 50k drilling rig and the air rotary method with stiff foam.

### **2.19.1 Drilling and Casing Installation**

Drilling activities for well NSH-023 commenced on 14 January 2015. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch outside diameter (0.25-inch wall thickness) was installed to 20 feet, and cement-bentonite grout was installed to land surface.

Borehole drilling continued on 14 January 2015 using a 13-inch diameter air-rotary hammer bit to a depth of 645 feet. Installation of an intermediate casing commenced on 15 January 2015; the casing included 8-inch nominal diameter LCS casing to approximately 645 feet. High-solids bentonite grout was installed from approximately 645 feet to land surface. The casing installation was completed on 16 January 2015.

Drilling of the bedrock with a 7½-inch hammer bit commenced on 16 January 2015; the borehole was drilled to a total depth of approximately 1,446 feet on 18 January 2015.

On 8 February 2015, the level of grout in the annulus was observed to have dropped to approximately 154 feet. A 5-foot thick interval of ¾-inch bentonite chips was installed in the annulus then Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NHS-023 is included as Figure 18, and well construction details are summarized in Table I.

### **2.19.2 Geophysical Logging**

A geophysical survey of the open borehole completion interval of well NSH-023 was conducted by IDS-Colog on 18 February 2015. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Sonic,
- Electrical Resistivity,
- Acoustic Borehole Televiwer,
- Neutron, and
- Gamma-Gamma Density.

Flow testing was conducted at NSH-023 from 18 to 19 February 2015. Ambient flow testing was performed with a CDFM tool. Injection was started at approximately 5 gpm. Injection continued for approximately 6 hours, with an injection rate varying from approximately 5.8 to 8.8 gpm. During the injection, the CDFM tool was run at intervals of interest. The well was then allowed to recover for approximately 1 hour. The flow logging survey included the following logs:

- CDFM: Ambient, and
- CDFM: Injection (average rate was 5.54 gpm).

On 26 May 2015, Southwest Exploration (Southwest) set up the necessary equipment at NSH-023 for flow testing during the twin test with NSH-024. While attempting to confirm the total depth of the hole, Southwest encountered an obstruction at approximately 906 feet and was unable to reach total depth. Planned testing and further logging were canceled due to lack of available depth to gather data.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.19.3 Lithology

The bottom of the alluvium was encountered at approximately 620 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 0.8 minute per foot. The upper portion of alluvium, to approximately 420 feet, is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily carbonate rocks. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts. During drilling of the borehole for intermediate casing, there was no evidence of saturation in the alluvium.

The Martin Formation was the first bedrock encountered at a depth of approximately 620 feet, and extended to 850 feet. The Martin Formation was observed to contain copper oxides from approximately 590 to 620 feet, 720 to 740 feet, at 780 feet, and 820 to 840 feet. The upper 300 feet of bedrock is observed to be highly fractured. The Upper Abrigo Formation was fully penetrated from approximately 850 to 1,190 feet and contained abundant iron oxides and minor copper oxides. Based on geophysical investigations, structural features and/or fractured areas were encountered from approximately 650 to 750 feet and 895 to 915 feet. The observed features correlate well with geological model features parallel to bedding and a reverse fault, respectively. The Middle Abrigo Formation was penetrated completely from approximately 1,190 to 1,260 feet and contained copper sulfides. The Lower Abrigo was encountered from approximately 1,260 feet to the total borehole depth of 1,446 feet and contained copper sulfides. Penetration rates in the Martin and Abrigo formations varied from approximately 0.7 to 3.8 minutes per foot. A detailed lithologic log is included in Appendix A.

### 2.19.4 Well Development

Several rounds of development were conducted on NSH-023 by both BJ Drilling and NEWP, due to scheduling demands and rig availability. Pump development was conducted by NEWP on 20 January 2015; NEWP installed a submersible pump (Grundfos, model 40S 100-30) to approximately 900 feet. The well was initially purged at a rate of approximately 18 gpm for approximately 1.5 hours, resulting in a drawdown of approximately 109 feet. Following the initial purge, the well was repeatedly purged and allowed to recover. The discharge initially contained foam and abundant sand. By the end of the pump development, the discharge had cleared of foam and the sand content had decreased.

Airlift development was conducted by BJ Drilling on 3 February 2015. BJ Drilling installed an airline to approximately 800 feet and started airlifting at approximately 10 gpm. The well was pumped and allowed to recover repeatedly at various settings. The airline was moved to approximately 900 feet and airlifted at approximately 25 gpm, then moved to approximately 1,000 feet and airlifted at approximately 30 gpm. Throughout development, discharge was cloudy to turbid and brown, with variable sand content ranging from approximately 0.1 to 0.9 ml/L. Field forms documenting well development are included in Appendix C.

## **2.20 WELL NSH-024**

Well NSH-024 was sited at location NSH-DC as the second well of a two-well pair intended to characterize the interior of the structural block located between the Forty Mile and Mojave #1 faults. Completion was planned in the oxide bedrock zone.

NSH-024 was designed and constructed as an open borehole completion with a planned depth of 1,445 feet; it was drilled by NEWP using the 50k drilling rig and the air rotary method.

### **2.20.1 Drilling and Casing Installation**

Drilling activities for well NSH-024 commenced on 18 January 2015. A 20-inch diameter borehole was drilled to 20 feet and LCS surface casing with a 14-inch nominal diameter was installed to 20 feet and grouted to the surface using neat cement grout.

Borehole drilling continued on 19 January 2015 using a 13-inch diameter air-rotary hammer bit to a depth of approximately 625 feet. Installation of intermediate casing for well NSH-024 commenced on 19 January 2015. The casing consisted of 8-inch nominal diameter LCS and was installed to 625 feet. Bentonite chips were installed to 612 feet and high-solids bentonite grout was installed to land surface pipe. The casing installation was completed on 20 January 2015.

Drilling of the bedrock with a 7½-inch hammer bit commenced on 20 January 2015; the borehole was drilled to a total depth of approximately 1,445 feet on 22 January 2015.

On 8 February 2015, the level of the cement in the annulus was observed to have dropped to approximately 109 feet. A 5-foot thick interval of ¾-inch bentonite chips was installed and Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NHS-024 is included as Figure 19, and well construction details are summarized in Table I.

### **2.20.2 Geophysical Logging**

A geophysical logging survey of the open bedrock interval of well NSH-024 was conducted by IDS-Colog on 23 January 2015, with oversight from Excelsior. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic, and
- Acoustic Borehole Televiewer.

Flow testing was conducted at NSH-024 from 19 to 20 February 2015. Ambient flow testing was performed with a CDFM tool. Injection was started at approximately 9 gpm. Injection continued for approximately 3.5 hours, with an injection rate varying from approximately 5.83 to 8.84 gpm. During the injection, the CDFM tool was run at intervals of interest. The flow logging survey included the following logs:

- CDFM: Ambient, and
- CDFM: Injection (average rate was 8.76 gpm).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.20.3 Lithology

The bottom of the alluvium was encountered at approximately 600 feet. Penetration rates in the alluvium were generally between approximately 0.35 and 0.65 minute per foot. The upper portion of alluvium (to approximately 380 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic rocks is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily carbonate rocks. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts. During drilling of the borehole for intermediate casing, there was no evidence of saturation in the alluvium.

The Martin Formation was the first bedrock encountered at approximately 600 feet, continuing to 800 feet, and contained highly mineralized zones from approximately 640 to 660 feet, 690 to 720 feet, and 770 to 800 feet. The Upper Abrigo Formation was penetrated from approximately 800 to 1,100 feet, and contained highly mineralized zones from approximately 850 to 860 feet and 1,020 to 1,030 feet. The Middle Abrigo Formation was penetrated from approximately 1,100 to 1,270 feet and contained a siliceous interval from approximately 1,200 to 1,250 feet, and copper oxide mineralization at approximately 1,160 feet, 1,220 to 1,240 feet, and at 1,260 feet. The Lower Abrigo was encountered from approximately 1,270 feet to the total depth of 1,445 feet, and contained copper sulfides and a siliceous zone from approximately 1,350 to 1,390 feet. Penetration rates in the bedrock varied from approximately 0.9 to 6 minutes per foot. A detailed lithologic log is included in Appendix A.

### 2.20.4 Well Development

Airline development was conducted by BJ Drilling on 2 February 2015. BJ Drilling installed an airline at NSH-024 to approximately 800 feet and started airlifting at approximately 10 gpm. The well was airlifted and allowed to recover repeatedly at various rates. The airline was set to approximately 840 feet, 900 feet, 940 feet, and 1,000 feet, resulting in discharge rates varying between approximately 10 to 40 gpm. Discharge was initially cloudy to turbid and brown with up to 0.6 ml/L sand; but as development continued, discharge color cleared and sand content decreased. Field forms documenting well development are included in Appendix C.

## 2.21 WELL NSH-025

Well NSH-025 was sited at location NSH-DP for the purpose of characterizing the sulfide zone within the interior of the structural block located between the Forty Mile, Great Sandy, and Atacama faults. Well NSH-025 was planned as a sulfide test well with completion in the Lower Abrigo Formation. NSH-025 is a 4-inch cased well design with a planned depth of 1,660 feet; the well was drilled by NEWP using the 685 drilling rig, and the air rotary method.

### 2.21.1 Drilling and Well Installation

Drilling activities for well NSH-025 commenced on 20 January 2015. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 12-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 20 January 2015 using a 10-inch diameter air-rotary hammer bit to a depth of 1,596 feet, and installation of well NSH-025 commenced on 24 January 2015 after geophysical logging was completed. Bentonite chips and fine sand (No. 20-40 mesh) were installed to approximately 1,560 feet to seal the bottom of the borehole. The well included 4-inch nominal diameter LCS; blank casing was installed to approximately 1,480 feet and the screened interval extended from 1,480 to 1,551 feet. Filter pack was installed to approximately 1,469 feet, transition sand was installed to 1,461 feet, and bentonite grout was installed to land surface on 26 January 2015. The top of the grout was observed to have dropped to approximately 20 feet on 8 February 2015; a 1-foot thick interval of bentonite chips was installed and Tacna gravel was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-025 is included as Figure 20, and well construction details are summarized in Table I.

### 2.21.2 Geophysical Logging

A geophysical logging survey of the borehole for well NSH-025 was conducted by IDS-Colog and commenced on 23 January 2015 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic, and
- Acoustic Borehole Televier.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.21.3 Lithology

The bottom of the alluvium was encountered at approximately 610 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 1.0 minute per foot. The alluvium consists of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts to 310 feet. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit, from approximately 310 to 600 feet, is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts.

The Martin Formation was the first bedrock encountered at a depth of interval from approximately 610 to 830 feet, and included altered carbonates. Penetration rates in the Martin Formation were generally between approximately 0.9 and 1.1 minutes per foot and no evidence of groundwater was observed during drilling.

The Upper Abrigo Formation was encountered at approximately 830 feet and penetration rates in the formation were between approximately 0.9 and 2.8 minutes per foot, and included tactite with iron and copper oxides. The Middle Abrigo was encountered from approximately 1,150 to 1,230 feet and included garnetite overlying the Lower Abrigo Formation from approximately 1,230 to 1,590 feet. Penetration rates in the Middle and Lower Abrigo formations were between approximately 1.0 and 4.0 minutes per foot. The Bolsa Quartzite was penetrated from approximately 1,590 to 1,596 feet and was hard (penetration rates were approximately 6 to 11 minutes per foot). A detailed lithologic log is included in Appendix A.

#### **2.21.4 Well Development**

Development of well NSH-025 included swab, bail, and pump activities by NEWP using a pump rig from 9 to 10 January 2015. A tightly fitting swab tool was reciprocated through the screened interval for approximately one hour; the solids were bailed out and a pump (Grundfos, model 40S 100-30) was set to 908 feet. During pumping, the discharge rate would decrease to approximately 2 gpm at a pumping water level at approximately 800 feet. By the end of the 3-day development period, the turbidity of the discharge was still turbid and sandy. Field forms documenting well development are included in Appendix C.

#### **2.22 WELL NSH-026**

Well NSH-026 was sited at location NSH-BE for the purpose of characterizing the interior of the structural block located between the Forty Mile, Great Sandy, and Atacama faults. Well NSH-026 was planned as an upper oxide test well with for completion in the Escabrosa and Martin formations and was not planned to intersect any significant structures. NSH-026 is an open borehole interval design with a planned depth of 1,135 feet; the well was drilled by NEWP using the 50k drilling rig, and the air rotary method.

##### **2.22.1 Drilling and Casing Installation**

Drilling activities for well NSH-026 commenced on 23 January 2105. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement was installed to land surface.

Borehole drilling continued on 23 January 2015 using a 13-inch diameter air-rotary hammer bit to a depth of 625 feet. Originally planned for 1,135 feet, well NSH-026 was terminated before reaching the planned depth due to borehole instability and abundant fracturing. Installation of intermediate casing in well NSH-026 commenced on 24 January 2015. The intermediate casing included 8-inch nominal diameter LCS casing installed from approximately 625 feet to land surface. Bentonite chips were installed to 612 feet, and high-solids bentonite grout was installed to land surface. The intermediate casing installation was completed on 25 January 2015.

Drilling of bedrock commenced on 25 January 2015 with a 7½-inch hammer bit. The borehole was drilled to a total depth of approximately 905 feet on 26 January 2015.



On 17 March 2015, the level of grout in the annulus was observed to have dropped to approximately 70 feet. A 5-foot thick interval of ¾-inch bentonite chips was installed and Tacna gravel was installed to surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-026 is included as Figure 21, and well construction details are summarized in Table I.

### 2.22.2 Geophysical Logging

A geophysical survey of the open borehole completion interval of well NSH-026 was conducted by IDS-Colog on 26 January 2015. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Sonic,
- Electrical Resistivity,
- Acoustic Borehole Televiewer,
- Neutron, and
- Gamma-Gamma Density.

Flow testing was conducted at NSH-026 on 20 February 2015, after pump development was completed. Ambient flow meter testing was performed with a CDFM tool and dynamic flow testing was performed with a spinner flow meter tool. Injection was started at approximately 80 gpm, then increased to 85 gpm and continued for approximately 2 hours. Spinner logs were run during the injection at 40 feet per minute. The spinner tool was also used to log stop counts at select depths. The well was then allowed to recover for approximately 1 hour. The flow logging survey included the following logs:

- CDFM: Ambient,
- Spinner: Ambient,
- Spinner: Injection (average was 84.34 gpm, 40 feet/min), and
- Spinner: Stop counts.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.22.3 Lithology

The bottom of the alluvium was encountered at approximately 600 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 1.4 minutes per foot. The upper portion of alluvium, to approximately 310 feet, is comprised of approximately 50 percent granitic clasts and 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily carbonate. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts. The alluvium did not appear saturated during drilling.

The Escabrosa Formation was the first bedrock encountered at approximately 600 feet, continuing to approximately 700 feet, and consisted of white marble and grey limestone. The Abrigo Formation was encountered at approximately 700 feet and consisted of altered and oxidized carbonates with copper



mineralization from 730 to 740 feet and 810 to 830 feet. Penetration rates in the Escabrosa and Abrigo formations were generally between approximately 0.9 to 1.8 minutes per foot; however, some intervals were as slow as 2.2 minutes per foot. A detailed lithologic log is included in Appendix A.

#### **2.22.4 Well Development**

On 7 February 2015, BJ Drilling attempted to develop NSH-026 by airlift. No discharge was observed with the airline set at depths of 780, 820, and 860 feet. The well was bailed for approximately 1 hour. The bailed water appeared clear to slightly cloudy with a slight reddish color and included a minor amount of foam. Field forms documenting well development are included in Appendix C.

### **2.23 WELL NSH-027**

Well NSH-027 was sited at location NSH-BG for the purpose of characterizing the interior of the structural block located between the Forty Mile, Mojave #1, and Great Sandy faults. Well NSH-027 was planned to be completed as a lower oxide test well with completion in the Upper Abrigo Formation. Well NSH-27 was planned to intersect the Mojave #1 fault. NSH-027 is a 4-inch cased hole design with a planned depth of 1,037 feet; the well was drilled by NEWP using the 50k drilling rig and the air rotary method.

#### **2.23.1 Drilling and Well Installation**

Drilling activities for well NSH-027 commenced on 26 January 2015. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed from 20 feet to land surface.

Borehole drilling continued on 27 January 2015 using a 12½-inch diameter air-rotary hammer bit to a depth of 1,022 feet. The first occurrence of groundwater during drilling was noted when drilling the 870- to 890-foot interval. At 970 feet, groundwater production increased to an estimated 300 gpm and varied depending on how much air pressure the driller was applying. The rate of groundwater production resulted in too much pressure for the air-rotary hammer to work properly and the hammer stopped functioning at 1,022 feet. Drilling was terminated at 1,022 feet depth.

Installation of well NSH-027 commenced on 29 January 2015 after geophysical logging was completed. The well included 6-inch nominal diameter LCS; blank casing was installed to 865 feet and the screened interval extended from 865 to 1,010 feet. The filter pack was installed from the bottom of the borehole to 850 feet, transition sand was installed to approximately 840 feet, high-solids bentonite grout was installed to 441 feet, bentonite chips were installed to 336 feet, and Tacna gravel was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-027 is included as Figure 22, and well construction details are summarized in Table I.

#### **2.23.2 Geophysical Logging**

A geophysical survey of the borehole for well NSH-027 was conducted by IDS-Colog and commenced on 29 January 2015. The geophysical survey was completed 16 December 2014 and included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic, and
- Acoustic Borehole Televiwer.

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Copies of the geophysical logs are included in Appendix D.

### 2.23.3 Lithology

The bottom of the alluvium was encountered at approximately 490 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 1.5 minutes per foot. The alluvium consists of sand with gravels with the top section, from land surface to 310 feet, being mixed lithics containing approximately 50 percent granitic clasts from the Texas Canyon quartz monzonite and 50 percent non-granitic clasts consisting primarily of sedimentary and metamorphic rocks. From 310 to 490 feet, the alluvium consists of approximately 90 percent granitic clasts and 10 percent non-granitic clasts.

The Martin Formation was the first bedrock encountered at approximately 490 feet and continued to 810 feet. The penetration rates in the Martin Formation were between approximately 1.0 and 1.6 minutes per foot. Significant fracturing was encountered from 700 to 800 feet. Below the Martin Formation was the Upper Abrigo Formation from 810 to 1,022 feet. Penetration rates for the Upper Abrigo Formation were between approximately 0.8 and 4.1 minutes per foot. Interpretations of ABI data revealed high angle fault between 975 to 982 feet and 989 to 993 feet. A detailed lithologic log is included in Appendix A.

### 2.23.4 Well Development

Pump development of well NSH-027 was conducted on 7 and 8 February 2015. A submersible pump (Grundfos, model #85S200-18) was installed to a depth of 849 feet. Pumping commenced at the maximum capacity of the pump and flow rates generally decreased with drawdown. NSH-027 was developed for approximately 13 hours at rates varying from 18 to 85 gpm. Maximum drawdown during development was approximately 183 feet. At the end of the development period, the water was cloudy and free of sand. Field forms documenting well development are included in Appendix C.

## 2.24 WELL NSH-028

Well NSH-028 was sited at location NSH-BH for the purpose of characterizing the interior of the structural block located between the Forty Mile, Mojave #1, and Great Sandy faults. Well NSH-028 was planned as an upper oxide test well with completion in the Martin Formation in a zone of bedding parallel structures. Well NSH-028 is an open borehole interval design with a planned depth of 820 feet; the well was drilled by NEWP using a 50k drilling rig and the air rotary method.

### 2.24.1 Drilling and Casing Installation

Drilling activities for well NSH-028 commenced on 27 January 2015. A 20-inch diameter borehole was drilled to 20 feet, LCS surface casing with a 14-inch nominal diameter was installed to 20 feet, and neat cement grout was installed to land surface.

Borehole drilling continued on 27 January 2015 using a 13-inch diameter air-rotary hammer bit to a depth of 544 feet. Directly below the alluvium, an interval of large fractures was encountered resulting in lost circulation from 500 to 530 feet. Heavy mud was pumped down the borehole to stabilize the borehole while drilling through this interval and circulation was recovered at approximately 535 feet. The borehole for the intermediate casing was deepened into competent bedrock to approximately 544 feet on 27 January 2015.

Installation of intermediate casing in well NSH-028 was completed on 28 January 2015 and included 8-inch nominal diameter LCS casing installed to 544 feet. Bentonite chips were installed to 541 feet, neat cement was installed to 473 feet, and high-solids bentonite grout was installed to land surface.

Drilling of bedrock commenced on 28 January 2015 with a 7 $\frac{7}{8}$ -inch hammer bit. The borehole was drilled to a total depth of approximately 800 feet on 29 January 2015.

On 31 January 2015, the level of the cement/grout in the annulus was observed to have dropped to approximately 90 feet. Tacna gravel was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-028 is included as Figure 23, and well construction details are summarized in Table I.

#### 2.24.2 Geophysical Logging

A geophysical logging survey of the open borehole interval of well NSH-028 was conducted by IDS-Colog on 29 January 2015. The geophysical survey included the following logs:

- Caliper/Gamma/Temperature/Conductivity,
- Electrical Resistivity,
- Sonic,
- Acoustic Borehole Televiwer,
- Neutron, and
- Gamma-Gamma Density.

Flow testing was conducted at NSH-028 on 21 February 2015. Ambient flow testing was performed with a CDFM tool. Injection was started at approximately 3.4 gpm, then adjusted to approximately 3.1 gpm, and continued for a total of 2.5 hours. During the injection, the CDFM tool was run at intervals of interest. The well was then allowed to recover for approximately 2 hours. The flow logging survey included the following logs:

- CDFM: Ambient, and
- CDFM: Injection (average injection rate was 3.23 gpm between 30 and 160 minutes).

The geologic logs collected were used in the interpretation of the lithology and were utilized by Excelsior to expand their geologic model. Interpretation of flow logging will be summarized in the aquifer testing report. Copies of the geophysical logs are included in Appendix D.

### 2.24.3 Lithology

The bottom of the alluvium was penetrated at approximately 500 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 0.9 minute per foot. The upper portion of alluvium (to approximately 300 feet) is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite, and the non-granitic clasts are primarily carbonate rocks. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts. During drilling of the borehole for the intermediate casing, there was no evidence of saturation in the alluvium.

The interval immediately below the alluvium consisted of large open fractures causing the drill to lose circulation and no drilled cuttings were recovered for this interval. Below the lost circulation zone, the Martin Formation was penetrated completely from 530 to 790 feet. Zones of moderate fracturing were noted from approximately 670 to 700 feet and 725 to 740 feet, mostly parallel to bedding planes. One structure is noted to dip west at approximately 725 feet. The Abrigo Formation was encountered from 790 feet to the bottom of the borehole. Penetration rates in the Martin and Abrigo formations were generally between approximately 0.6 to 1.9 minutes per foot. A detailed lithologic log is included in Appendix A.

### 2.24.4 Well Development

Several rounds of development were conducted on NSH-028 by both BJ Drilling and NEWP due to scheduling demands and rig availability. On 4 February 2015, BJ Drilling Company set up on NSH-028 to conduct airlift development. The airline was installed to approximately 760 feet and the well was initially purged at approximately 5 gpm for 1 hour. Following the initial purge, the well was repeatedly airlifted and allowed to recover. The discharge was initially brown and turbid with foam and contained 0.5 to 1.5 ml/L solids (sand and gravel). By the end of the airlifting development, no foam was observed in the groundwater, turbidity had decreased, and the sand content was approximately 0.2 ml/L.

On 5 February 2015, NEWP installed a submersible pump (Grundfos, model 40S 100-30) to approximately 750 feet. On 6 February 2015, the well was purged at approximately 30 gpm. The pumping rate was adjusted to approximately 1 gpm and pumped for 2 hours. The rate was then increased to approximately 2 gpm and pumped for 1.5 hours. At the end of the development period, total drawdown was approximately 125 feet. Field forms documenting well development are included in Appendix C.

### 2.25 WELL NSH-029

Well NSH-029 was sited to serve as a water level observation point for aquifer testing. Well NSH-029 was planned for completion in the Martin Formation with the intention of monitoring groundwater elevation during pumping tests conducted at wells NSH-018 and NSH-020. NSH-029 is 2-inch piezometer design with a planned depth of 710 feet; the well was drilled by BJ Drilling using the T3 drilling rig and the air rotary method.

### 2.25.1 Drilling and Well Installation

Drilling activities for well NSH-029 commenced on 28 January 2015. An 11-inch diameter borehole was drilled to 19 feet, LCS surface casing with a 7-inch nominal diameter was installed to 19 feet, and neat cement was installed from 19 feet to land surface.

Borehole drilling continued on 28 January 2015 using a 6½-inch diameter air-rotary hammer bit to a depth of 710 feet. Installation of well NSH-029 commenced on 29 January 2015 (no geophysical logging was conducted). The well included 2-inch nominal diameter LCS; blank casing was installed to approximately 604 feet and the screened interval extended from 604 to 709 feet. Filter pack was installed from approximately 575 to 710 feet, bentonite chips were installed to 554 feet, and formation stabilizer (¾-inch pea-gravel and Tacna gravel) was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-029 is included as Figure 24, and well construction details are summarized in Table I.

### 2.25.2 Lithology

The bottom of the alluvium was encountered at approximately 500 feet. Penetration rates in the alluvium were generally between 0.5 and 1.1 minutes per foot. The alluvium consists of approximately 50 percent granitic clasts and 50 percent non-granitic clasts to 290 feet. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit, from 290 to 500 feet, is comprised of approximately 90 percent granitic clasts and 10 percent non-granitic clasts.

The Martin Formation was the first bedrock encountered at approximately 500 feet to the total depth of 710 feet. Penetration rates in the Martin Formation were generally between approximately 1.0 and 1.8 minutes per foot. A detailed lithologic log is included in Appendix A.

### 2.25.3 Well Development

Development of well NSH-029 included bailing conducted by BJ Drilling using a pump rig from 8 to 9 February 2015. Airlift development was attempted but the airline was not submerged enough to discharge water. A total of approximately 5 gallons was bailed from the well before the well bailed dry. By the end of the development period, the turbidity of the discharge appeared very cloudy. Field forms documenting well development are included in Appendix C.

## 2.26 WELL NSH-030

Well NSH-030 was sited to serve as a water level observation point for aquifer testing. Well NSH-030 was planned for completion in the Escabrosa Formation with the intention of monitoring groundwater elevation during pumping tests conducted at wells NSH-018 and NSH-020. NSH-030 is a 2-inch piezometer design with a planned depth of 740 feet; the well was drilled by BJ Drilling using a T3 drilling rig and the air rotary method.

### 2.26.1 Drilling and Well Installation

Drilling activities for well NSH-030 commenced on 29 January 2015. An 11-inch diameter borehole was drilled to 19 feet, LCS surface casing with a 7-inch nominal diameter was installed to 19 feet, and neat cement grout was installed to land surface.

Borehole drilling continued on 29 January 2015 using a 6½-inch diameter air-rotary hammer bit to a depth of 740 feet. Installation of well NSH-030 commenced on 3 February 2015 (no geophysical logging was conducted). The well included 2-inch nominal diameter LCS; blank casing was installed to approximately 600 feet and the screened interval extended from 600 to 706 feet. Filter pack was installed from 592 to 740 feet, bentonite chips were installed to 567 feet, and formation stabilizer (¾-inch pea-gravel) was installed to land surface.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-030 is included as Figure 25, and well construction details are summarized in Table I.

### 2.26.2 Lithology

The bottom of the alluvium was encountered at 330 feet. Penetration rates in the alluvium were generally between approximately 0.5 and 0.8 minute per foot. The alluvium consists of approximately 50 percent granitic clasts and 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks.

The Horquilla Formation was encountered immediately below the alluvium from 330 feet to 420 feet, and included fine-grained limestone/marble. Penetration rates in the Horquilla were generally between approximately 1.3 and 3.3 minutes per foot. Underlying the Horquilla Formation, the Black Prince Formation was penetrated at approximately to 560 feet, and included fine- to medium-grained limestone. Beneath the Black Prince, the Escabrosa Formation was penetrated at approximately to the bottom of the borehole at approximately 740 feet and included fine-grained limestone and marble. A detailed lithologic log is included in Appendix A.

### 2.26.3 Well Development

Development of well NSH-030 included bailing conducted by BJ Drilling on 8 and 22 February 2015. Airlift development was attempted but the airline was not submerged enough to discharge water. A total of approximately 7 gallons was bailed from the well before the well bailed dry. By the end of the development period, the turbidity of the discharge appeared turbid. Field forms documenting well development are included in Appendix C.

## 2.27 WELL NSH-031

Well NSH-031 was sited to serve as a water level observation point for aquifer testing. Well NSH-031 was planned for completion in the Abrigo Formation with the intention of monitoring groundwater elevation during pumping tests conducted at wells NSH-007, NSH-008, NSH-009, NSH-010, and NSH-014B. NSH-031 was a 2-inch piezometer design with a planned depth of 820 feet; the well was drilled by BJ Drilling using the T3 drilling rig and the air rotary method.

### 2.27.1 Drilling and Well Installation

Drilling activities for well NSH-031 commenced on 4 February 2015. An 11-inch diameter borehole was drilled to 19 feet, LCS surface casing with a 7-inch nominal diameter was installed to 19 feet, and neat cement was installed to land surface.

Borehole drilling continued on 4 February 2015 using a 6½-inch diameter air rotary hammer bit to a depth of 820 feet. Installation of well NSH-031 commenced on 5 February 2015 (no geophysical logging was conducted). The well included 2-inch nominal diameter LCS; blank casing was installed to approximately 721 feet and the screened interval extended from 721 to 805 feet. Filter pack was installed to 700 feet, bentonite chips were installed to 683 feet to prevent the high-solids bentonite grout from flowing downward. Installation of the high-solids bentonite grout from 500 feet to land surface was completed on 6 February 2015.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-031 is included as Figure 26, and well construction details are summarized in Table I.

### 2.27.2 Lithology

The bottom of the alluvium was encountered at approximately 420 feet. Penetration rates in the alluvium were generally between approximately 0.2 and 1.0 minute per foot. The upper portion of alluvium to 320 feet is comprised of approximately 50 percent granitic clasts and 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit is comprised of approximately 90 percent granitic clasts and 10 percent non-granitic clasts.

The Martin Formation was the first bedrock encountered at approximately 420 feet, continuing to 620 feet, and included fine- to medium-grained marble and garnetite. Penetration rates in the Martin were generally between approximately 0.9 and 1.1 minutes per foot. The Upper Abrigo was encountered at 620 feet to the bottom of the borehole at 820 feet. A possible fault zone was encountered between approximately 620 and 640 feet at the top of the Upper Abrigo Formation. The Abrigo Formation included altered carbonates; a second possible fault zone was encountered between approximately 740 and 760 feet. A detailed lithologic log is included in Appendix A.

### 2.27.3 Well Development

Development of well NSH-031 included bailing conducted by Haley & Aldrich on 7 March 2015. Prior to bailing, the water level was measured at approximately 563 feet. A total of approximately 23 gallons was bailed from the well. By the end of the development period, the turbidity of the discharge appeared turbid to cloudy; the water level was measured at approximately 580 feet and was observed to be rising after bailing was complete. Field forms documenting well development are included in Appendix C.

## 2.28 WELL NSH-032

Well NSH-032 was sited as a water level observation point for aquifer testing. Well NSH-032 was planned for completion in the Abrigo Formation with the intention of monitoring groundwater elevation during pumping tests conducted at wells NSH-007, NSH-008, NSH-009, NSH-010, and NSH-014B. The planned depth of well NSH-032 was 820 feet; the well was drilled by BJ Drilling using the T3 drilling rig, and the air rotary method.



### 2.28.1 Drilling and Well Installation

Drilling activities for well NSH-032 commenced on 6 February 2015. An 11-inch diameter borehole was drilled to 19 feet, LCS surface casing with a 7-inch outside diameter (0.155-inch wall thickness) was installed to 19 feet, and neat cement was installed from 19 feet to land surface.

Borehole drilling continued on 8 February 2015 using a 6½-inch diameter air rotary hammer bit to a depth of 820 feet; installation of well NSH-032 commenced on 9 February 2015. The well included 2-inch nominal diameter LCS; blank casing was installed to approximately 720 feet and the screened interval extended from 720 to 804 feet. Filter pack was installed from total depth to 700 feet, transition sand was installed to 690 feet, and high-solids bentonite grout was installed to land surface on 10 February 2015.

Well construction field forms are included in Appendix B, an as-built well diagram for NSH-032 is included as Figure 27, and well construction details are summarized in Table I.

### 2.28.2 Lithology

The bottom of the alluvium was encountered at approximately 420 feet. Penetration rates in the alluvium were generally between approximately 0.4 and 1.0 minute per foot. The upper portion of alluvium to approximately 320 feet is comprised of approximately 50 percent granitic clasts and approximately 50 percent non-granitic clasts. The lithology of the granitic clasts is consistent with the Texas Canyon quartz monzonite and the non-granitic clasts are primarily sedimentary and metamorphic rocks. The lower portion of the alluvial unit (below approximately 320 feet) is comprised of approximately 90 percent granitic clasts and approximately 10 percent non-granitic clasts.

The Martin Formation was the first bedrock encountered at approximately 420 feet, continuing to 620 feet, and included fine- to medium-grained marble and garnetite. Penetration rates in the Martin were generally between approximately 0.5 and 0.9 minute per foot. A possible fault zone was encountered between approximately 620 and 640 feet overlying the Abrigo Formation from approximately 620 feet to the bottom of the borehole at approximately 820 feet. The Abrigo Formation included altered carbonates with trace amounts of copper oxide minerals. A detailed lithologic log is included in Appendix A.

### 2.28.3 Well Development

Development of well NSH-032 included bailing conducted by NEWP and airlift conducted by BJ Drilling. Bailing was not successful on 18 February 2015 and the well was airlifted developed on 23 and 24 February 2015. The well was developed by the airlift method for a total of approximately 5 hours and the purge rate was approximately 1 gpm. By the end of the development period, the turbidity of the discharge appeared cloudy to clear. Field forms documenting well development are included in Appendix C.



### **3. Corehole Development Summary**

A total of 35 existing coreholes were attempted to be developed by airlift methods so that they may be used as observation points during aquifer testing and during monthly and quarterly data collection events conducted by Excelsior. Work for the corehole development program was contracted to BJ Drilling by Excelsior and conducted between 20 November 2014 and 27 March 2015. Haley & Aldrich tracked the progress of the corehole development program and provided various levels of contractor oversight based on direction from Excelsior. More oversight was provided early in the corehole development program and less oversight was provided as the program progressed.

Initial work at each corehole included the contractor welding a diverter to the surface casing of the corehole to control the airlift discharge from the corehole. A pump hoist rig was used to install 1½-inch nominal diameter, flush-threaded steel tubing (through the diverter) to between approximately 900 to 1,100 feet to provide enough submergence to discharge water. An air compressor rig was used to conduct the airlift development.

In general, the initial period of airlift was continuous and generally extended several hours to remove drilling fluids from the corehole. After drilling fluids were purged, the airlift pumping was periodically stopped to allow the water level in the corehole to recover and surge to assist in development of the corehole. Each corehole was considered developed once the discharge from the corehole was continuous and cloudy to clear in appearance. The duration of the period required to develop each corehole varied from several hours to several days. Some coreholes could not be developed by the airlift method possibly due to enlarged corehole diameters or due to a lack of hydraulic connection to the formation. Some coreholes did not develop uniformly; at some locations, the discharge was turbid at the end of the development period.

Corehole development activities are summarized on Table III. Field data collected from corehole development activities early in the development program are presented in Appendix E. Analysis of the water level data collected from the coreholes are summarized in the aquifer testing report.

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**TABLE I**  
**Well Construction Summary**  
 Gunnison Copper Project  
 Excelsior Mining Corp.

Well ID	Planned Hole ID	ADWR Registration Number	State Plane Coordinates		Drilling Start Date	Construction Complete Date	Well Design	Borehole Depth (feet bgs)	Borehole diameter, inches (Depth Interval, feet)	Screened Interval <sup>1</sup> (feet)
			Easting	Northing						
NSH-007	NSH-CP	55-917430	536953.072	394847.35	10/16/2014	10/23/2014	Open Borehole Interval (with PVC liner)	620	18 (0-20) 12 (20-469) 7 7/8 (469-640)	469-460 (PVC liner 356-496, 536-616)
NSH-008	NSH-CQ	55-917429	537052.423	395046.862	10/24/2014	10/29/2014	4- inch Cased	900	20 (0-20) 10 (20-900)	720-840
NSH-009	NSH-CS	55-917433	537651.191	395519.311	10/30/2014	11/8/2014	4-inch Cased	1,060	20 (0-20) 10 (20-1060)	813-995
NSH-010	NSH-CT	55-917434	537800.757	395448.292	10/30/2014	11/3/2014	Open Borehole Interval (with PVC liner)	720	20 (0-20) 13 (20-546) 7 7/8 (546-720)	546-720 (PVC liner 379-599, 693-699)
NSH-012	NSH-CU	55-917435	537951.517	395496.694	11/3/2014	11/20/2014	4-inch Cased	504	20 (0-20) 10 (20-504)	430-490
NSH-013	NSH-BW	55-917436	538252.445	394296.808	11/3/2014	11/7/2014	Open Borehole Interval	1,070	20 (0-20) 13 (20-650) 7 7/8 (650-1,070)	650-1,070
NSH-014B	NSH-DN	55-917432	537863.293	395535.279	11/10/2014	11/22/2014	4-inch Cased	1,277	20 (0-20) 10 (20-1,002) 9 7/8 (1,002-1,277)	1,180-1,260
NSH-015	NSH-CJ	55-224029	537801.792	393098.33	11/11/2014	11/15/2014	Open Borehole Interval	820	20 (0-20) 12 (20-585) 7 7/8 (585-820)	585-820
NSH-016	NSH-CL	55-224030	537654.299	393133.292	11/15/2014	11/19/2014	Open Borehole Interval (with PVC liner)	820	20 (0-20) 13 (20-580) 7 7/8 (580-820)	580-820( PVC liner 301 601, 641-701)
NSH-017	NSH-CK	55-224099	537953.722	393116.061	11/19/2014	12/7/2014	6-inch Cased	1,200	20 (0-20) 12 (20-930) 11 5/8 (930-1200)	940-1181
NSH-018	NSH-CV	55-224100	539882.712	394345.762	11/23/2014	12/21/2014	4-inch Cased	997	20 (0-20) 10 (20-960) 9 7/8 (960-997)	610-992
NSH-019	NSH-DA	55-224031	538350.895	393394.81	12/7/2014	12/21/2014	Open Borehole Interval	1,410	20 (0-20) 13 (20-638) 7 7/8 (638-1188) 7 1/2 (1188-1410)	N/A
NSH-020	NSH-CX	55-224035	539881.346	394183.965	12/8/2014	12/20/2014	4-inch Cased	1,600	20 (0-20) 10 (20-1130) 9 7/8 (1130-1600)	1060-1181, 1241-1402, 1472-1582
NSH-021C	NSH-DB	55-224032	538373.959	393462.015	1/10/2015	2/8/2015	Open Borehole Interval	1,400	20 (0-20) 13 (20-624) 7 7/8 (624-1400)	624-1,400

TABLE I

## Well Construction Summary

Gunnison Copper Project

Excelsior Mining Corp.

Well ID	Planned Hole ID	ADWR Registration Number	State Plane Coordinates		Drilling Start Date	Construction Complete Date	Well Design	Borehole Depth (feet bgs)	Borehole diameter, inches (Depth Interval, feet)	Screened Interval <sup>1</sup> (feet)
			Easting	Northing						
NSH-022	NSH-BF	55-224097	539336.194	392996.22	12/20/2014	1/19/2015	6-inch Cased	1,170	20 (0-20) 12 (20-660) 11 7/8 (660-835) 11 5/8 (835-1170)	1,010-1,131
NSH-023	NSH-DD	55-224034	538600.754	393545.935	1/14/2015	1/17/2015	Open Borehole Interval	1,446	20 (0-20) 13 (20-645) 7 7/8 (645-1446)	645-1,446
NSH-024	NSH-DC	55-224033	538538.574	393510.798	1/18/2015	1/22/2015	Open Borehole Interval	1,445	20 (0-20) 13 (20-625) 7 7/8 (625-1445)	625-1,445
NSH-025	NSH-DP	55-224158	538490.268	393644.068	1/20/2015	1/26/2015	4-inch Cased	1,596	20 (0-20) 10 (20-1596)	1,480-1,551
NSH-026	NSH-BE	55-224036	539341.942	392857.383	1/23/2015	1/26/2015	Open Borehole Interval	905	20 (0-20) 13 (20-625) 7 7/8 (625-905)	625-905
NSH-027	NSH-BG	55-224157	539011.455	391828.665	1/26/2015	2/1/2015	6-inch Cased	1,022	20 (0-20) 12 (20-1022)	865-1,010
NSH-028	NSH-BH	55-224156	539065.387	391979.953	1/27/2015	1/29/2015	Open Borehole Interval	800	20 (0-20) 13 (20-544) 7 7/8 (544-800)	544-800
NSH-029	NSH-DR	55-917775	539877.409	393898.717	1/28/2015	1/29/2015	Piezometer	710	11 (0-19) 6.5 (19-710)	604-709
NSH-030	NSH-DQ	55-917777	539886.861	394642.092	1/29/2015	2/3/2015	Piezometer	740	11 (0-19) 6.5 (19-740)	600-706
NSH-031	NSH-DS	55-917782	537432.527	395949.843	2/4/2015	2/6/2015	Piezometer	820	11 (0-19) 6.5 (19-820)	721-805
NSH-032	NSH-DT	55-917783	537746.449	395755.033	2/6/2015	2/10/2015	Piezometer	820	11 (0-19) 6.5 (19-820)	720-804

## NOTES:

<sup>1</sup> Open borehole interval for feasibility design wells

TABLE II

## Geophysical Logging Summary

Gunnison Copper Project

Excelsior Mining Corp.

Well ID	Caliper Gamma T/FR	Sonic	E log	ABI	Neutron	Density (Gam-Gam)	Ambient Flowmeter (type)	Dynamic Flowmeter (type)
NSH-007	X			X				
NSH-008	X	X	X	X	X	X	Heat Pulse Flow Meter	
NSH-009	X	X	X	X	X	X	CEDFM	CDFM
NSH-010	X	X	X					
NSH-011	X	X	X					
NSH-012	X							
NSH-013	X	X	X	X	X	X	CDFM	CDFM
NSH-014B	X	X	X					
NSH-015	X	X	X	X	X	X	CDFM	SPM
NSH-016	X	X	X	X			CDFM	
NSH-017	X	X	X	X			CDFM	CDFM
NSH-018	X	X	X	X			CDFM	CDFM
NSH-019	X	X	X	X	X	X	CDFM	SFM
NSH-020	X	X	X	X			CDFM	CDFM
NSH-021C	X	X	X	X			CDFM	SFM
NSH-022	X	X	X	X				
NSH-023	X	X	X	X	X	X	CDFM	CDFM
NSH-024	X	X	X	X			CDFM	CDFM
NSH-025	X	X	X	X				
NSH-026	X	X	X	X	X	X	CDFM	SFM
NSH-027	X	X	X	X				
NSH-028	X	X	X	X	X	X	CDFM	CDFM

**Note:** CDFM - Corehole Dynamic Flow Meter (Electromagnetic flow meter tool for low flow conditions)

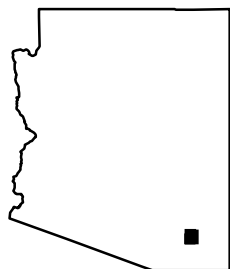
SPM - Spinner Flow Meter (mechanical tool for high flow conditions)

TABLE III  
Corehole Cleanout Summary  
Gunnison Copper Project  
Excelsior Mining Corp.

ID	Cleanout Date(s)	Total Well Depth (feet bgs)	Airline Depth (feet bgs)	Pre-cleanout SWL (feet bgs)	Post-cleanout SWL (feet bgs)	Discharge** (gpm)	Total Water Purged (gallons)	Construction Details
NSD-030	11/21-22/14	767	756	358	238.86	<1 to 10	3,000	Cased to 240' bgs, open hole below
NSD-037	12/5-9/2014	1,200	440 to 945 [800]	352.3	461.7*	10 to 90	2,500	Cased to 524' bgs, open hole below
NSD-026	12/9/2014	1,168	504 to 525 [525]	416.5	419.2*	10	1,500	Cased to 431' bgs, open hole below
NSD-002	12/10-12/2014	1,907	600 to 1250 [1250]	575.9*	591.7*	1.5 to 40	4,500	Cased to 580' bgs, open hole below
NSD-001	12/12-13/2014	1,509	800 to 1220 [1220]	605.5*	612.4*	<10 to 20	1,200	Cased to 460' bgs, open hole below
NSD-041	12/13-14/14	1,600	1,220	546	529.7*	30 to 40	13,200	Cased to 410' bgs, open hole below
NSD-042	12/15-16/14	1,700	1,220	Blocked*	Obstruction at 510	5 to 15	900	
NSM-009	12/16-17/14	1,349	1,220	602	593.9*	35 to 40	12,000	Cased to 585' bgs, open hole below
NSM-005A	12/18-20/2014	1,171	1,000		588	10 to 15	5,900	Cased to 592' bgs, open hole below
NSM-043	12/20/2014	1,736	1,200			10 to 15	1,900	Cased to 628' bgs, open hole below
NSD-027	1/5-6/2015	1,004	960	453.9*	505.37*	15	2,700	Cased to 400' bgs, open hole below
NSD-028	1/7/2015	755	740	436.8*	444.97*	9	2,900	Cased to 400' bgs, open hole below
DC-9	1/12-13/15	1,500	600	359.2		Initial return had hydrocarbon odor, immediately ceased purging		
NSD-010	1/16/2015	1,509	940	564.5*	565.2*	<1 to 3.5	100+	Cased to 543' bgs, open hole below
NSM-011	1/19-20/2015	1,340	1,000	576.5*	577.84*	40	5,400	Cased to 540' bgs, open hole below
J-5	1/22-23/2015	1,475	600 to 1,100 [1100]	550	605.3*	1 to 7	2,300	
NSD-019	1/26/2015	1,454	1,100	485.1*	630.4*	20	5,800	Cased to 620' bgs, open hole below
NSM-007	1/27-28/2015	1,168	1,000	636	651.1*	10 to 15	6,300	Cased to 604' bgs, open hole below
NSD-001	1/29/2015	1,150	1,100	612.4*	616.2*	17 to 20	2,200	Cased to 458' bgs, open hole below
NSD-022	2/4-5/2015	1,339	Bailed at top of water Colum and ~1,250 [top of water column]	547.9*	555*	Bailer (3" ID x 20') ran ~15 times over 45 minutes		Cased to 499' bgs, open hole below
NSD-012	2/5-6/2015	1,732	900	536.6	538.1*	No returns noted, used bailer (1" x 20') to investigate (obstruction at 400' bgs)		Cased to 422' bgs, open hole below
NSD-006	2/6/2015	2,000	1,000	564.56	Block at 85*			Cased to 470' bgs, open hole below
NSM-008	2/10-11/15	1,250	900	Full of mud*	619.13*	20 to 22	10,400	Cased to 540' bgs, open hole below
NSM-006	2/13-16/2015	1,273	800	630.6*	641.45*	5	1,500	Cased to 548' bgs, open hole below
CS-6	2/16-18/2015	2,160 (926 after collapse)	Bailed at 795	643	646.2*	-	1.25	Hole collapsed at 936' bgs
NSD-011	2/18/2015	1,438	900 to 1,100 [1,100]	633	635.7*	3 to 5	500	Cased to 644' bgs, open hole below
NSM-001	2/19-20/2015	1,150	900	641	639.1*	1 to 3	500+	
CS-11	2/20/2015	2,084	900	446.2*	441*	1 to 2	600+	
NSD-032	<3/16/15	905	-	315.8*	333.95*	-	-	
NSD-017	3/16/2015	1,349	600	505.3	505.36	-	5	Cased to 400' bgs, open hole below
NSD-016	3/17-18/2015	1,689	780	540.17	540.1	<1 to 1	50	Cased to 420' bgs, open hole below
NSD-014	3/18/2015	1,913	900	540.9*	542.7	3	400	Cased to 402' bgs, open hole below
NSD-005	3/19/2015	1,908	900	495.6*	518.64	3 to 4	200+	Cased to 420' bgs, open hole below
NSM-010A	3/20/2015	839	800	Blocked at 210*	549.62	No returns noted		Cased to 425' bgs, open hole below
NSD-015	3/20/2015	1,956	795	539.5*	512.65	1 to 2	400	Cased to 400' bgs, open hole below
J-9	3/27/2015	1,158	700 to 1,100 [1,100]		637.7*	No returns noted		

**NOTES:**  
\* = from Excelsior water level sweeps  
\*\* = visual approximation  
[ ] = depth purging completed  
bgs = below ground surface  
gpm = gallons per minute  
SWL = surface water level

GIS FILE PATH: G:\Projects\Excelsior\_Mining\_Corp\GIS\MapProjects\2015\_07\38681\_001\_01\_Site\_Vicinity.mxd — USER: gcarson — LAST SAVED: 7/2/2015 8:07:43 AM



MAP SOURCE: ESRI  
USGS QUAD: DRAGON, ARIZONA  
SITE COORDINATES: 32°56.31"N, 110°2'40.47"W

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EXCELSIOR MINING CORP.  
GUNNISON COPPER PROJECT  
COCHISE COUNTY, ARIZONA

### SITE VICINITY MAP

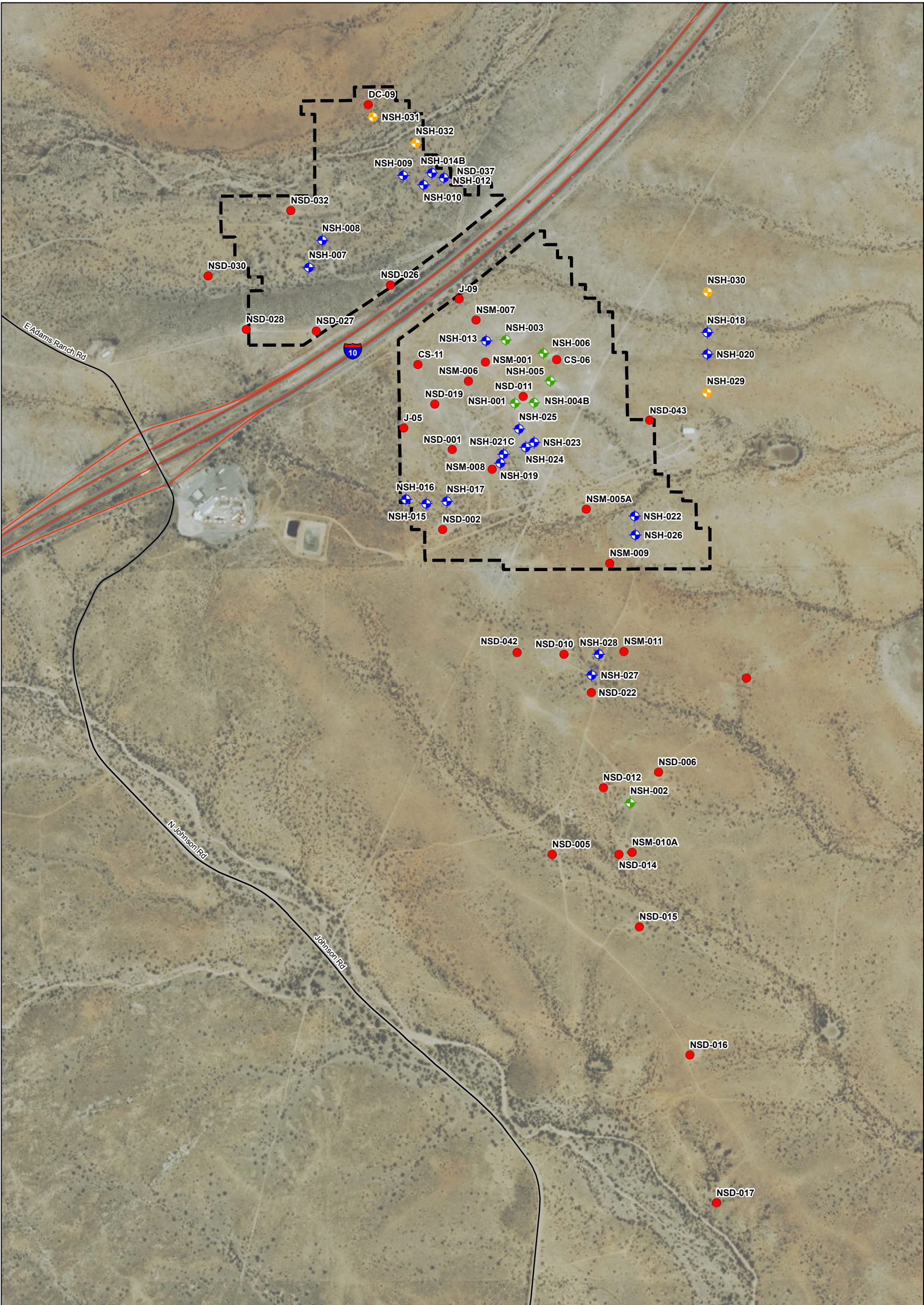
**Excelsior**  
MINING CORP

APPROXIMATE SCALE: 1 IN = 4000 FT  
JULY 2015

FIGURE 1



GIS FILE PATH: G:\Projects\Excelsior Mining Corp\38681-Mine Planning\GIS\GIS from BOI\MapProjects\2015\_07\38681\_001\_02\_Well\_Location.mxd — USER: bklenenberger — LAST SAVED: 7/6/2015 2:21:07 PM



LEGEND

- DEVELOPED COREHOLE
- EXISTING HYDROLOGIC TEST WELL
- NEW HYDROLOGIC TEST WELL
- PIEZOMETER

- INTERSTATE
- LOCAL ROAD
- PROPOSED PHASE 1 PERMITTING BOUNDARY

NOTE  
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

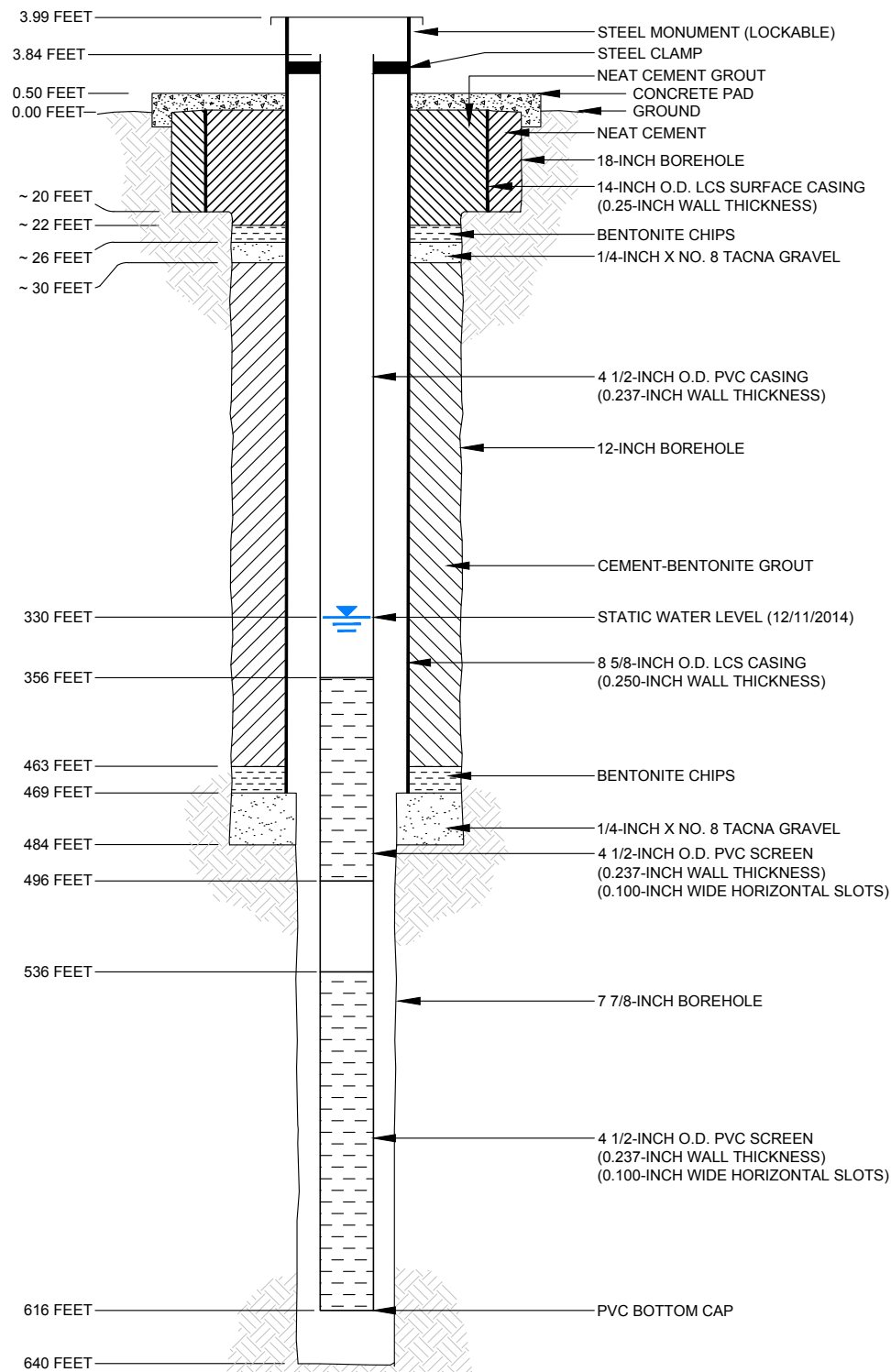
EXCELSIOR MINING CORP.  
GUNNISON COPPER PROJECT  
COCHISE COUNTY, ARIZONA

WELL LOCATION MAP

JULY 2015

FIGURE 2



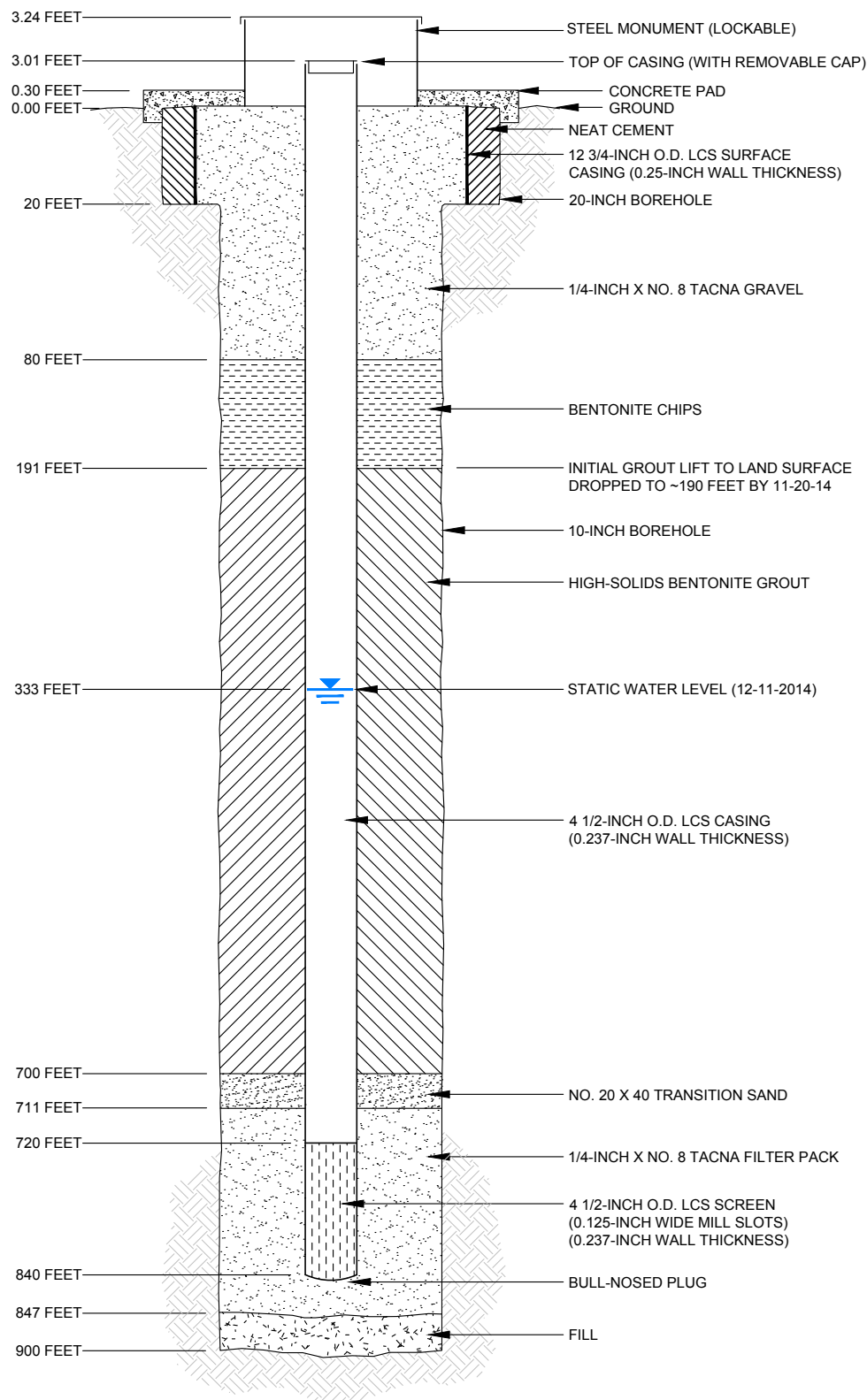


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

### NSH-007 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 3

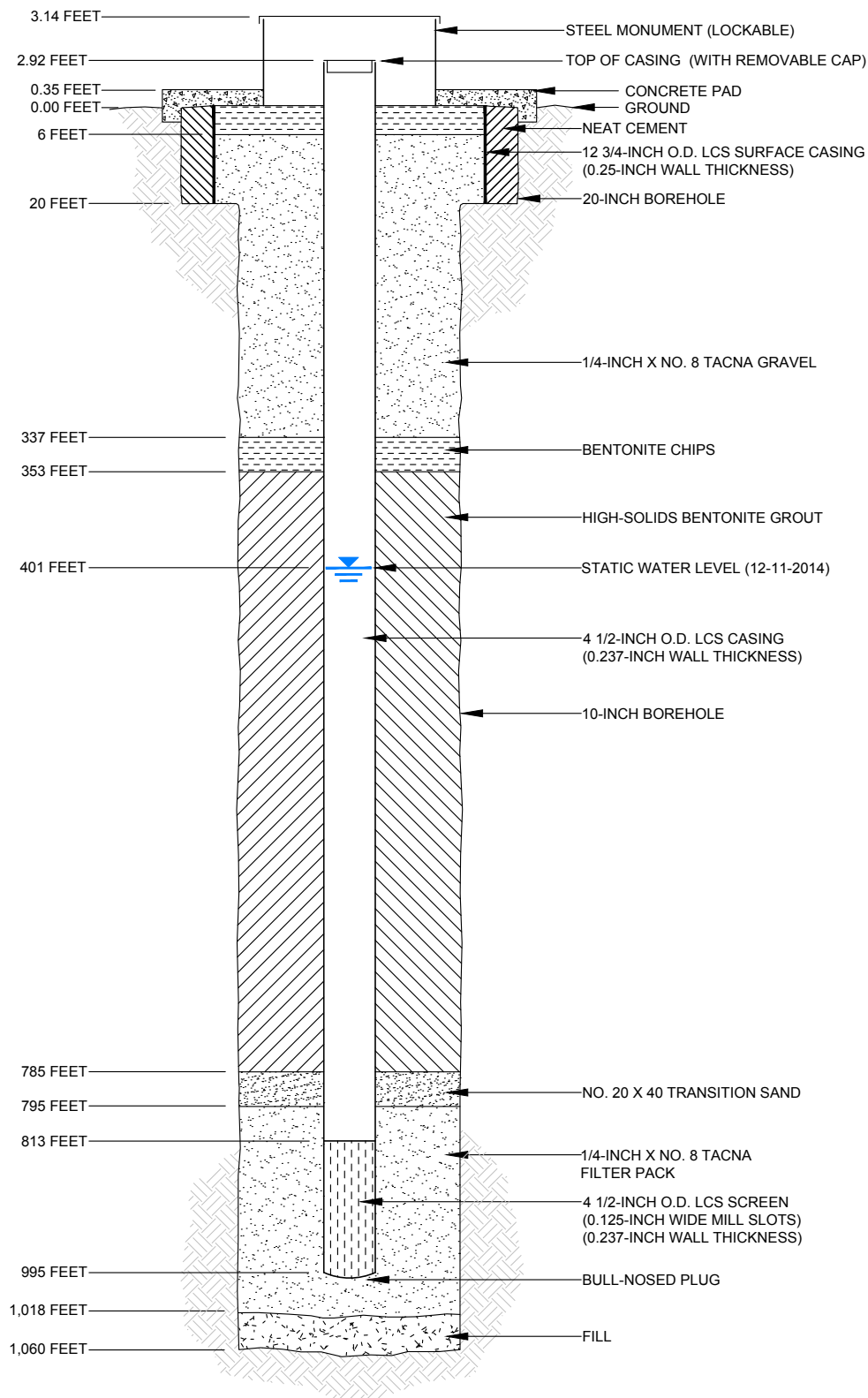


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-008 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 4

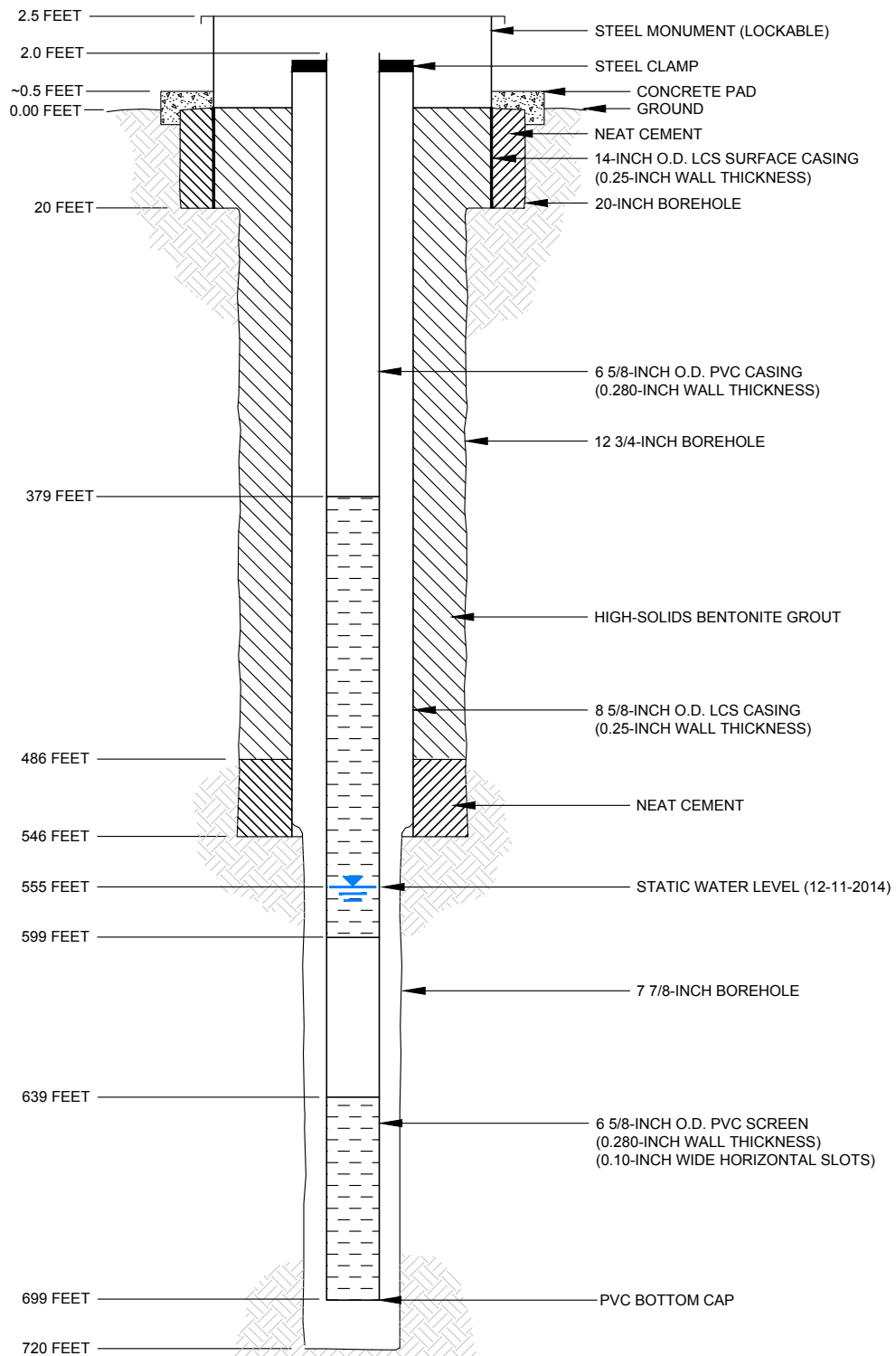


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

### NSH-009 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 5

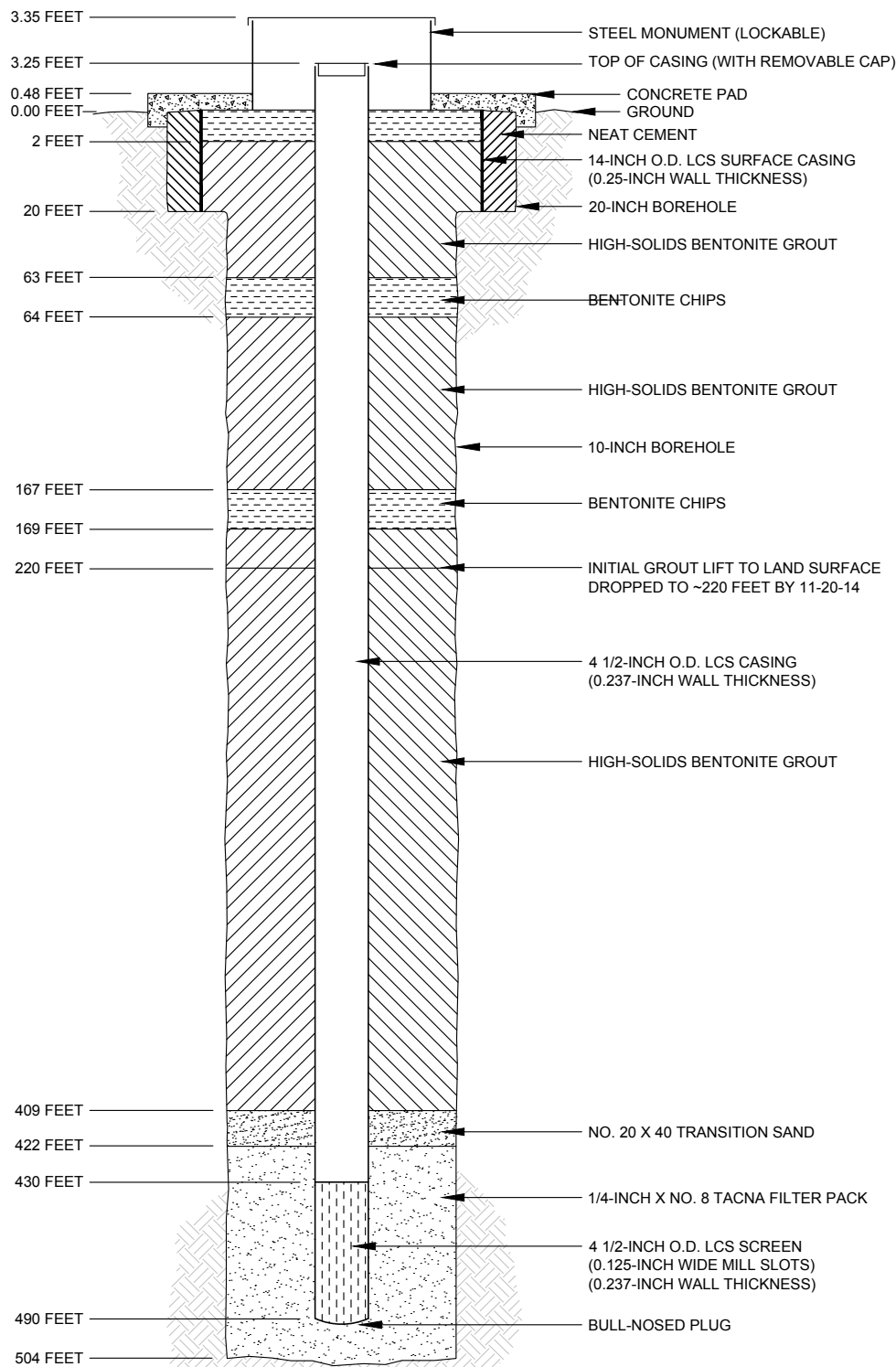


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-010 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 6

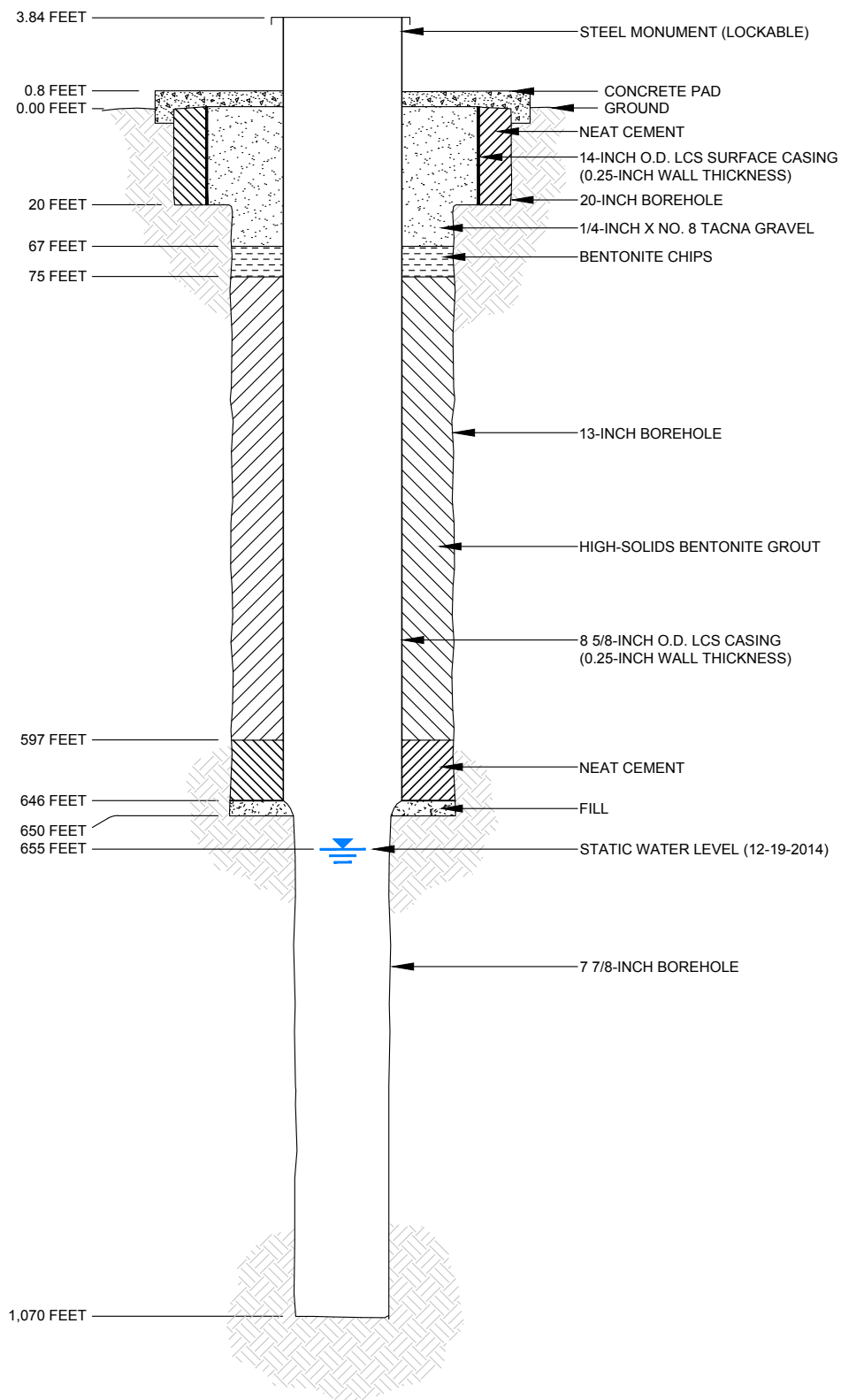


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GUNNISON, ARIZONA

## NSH-012 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 7

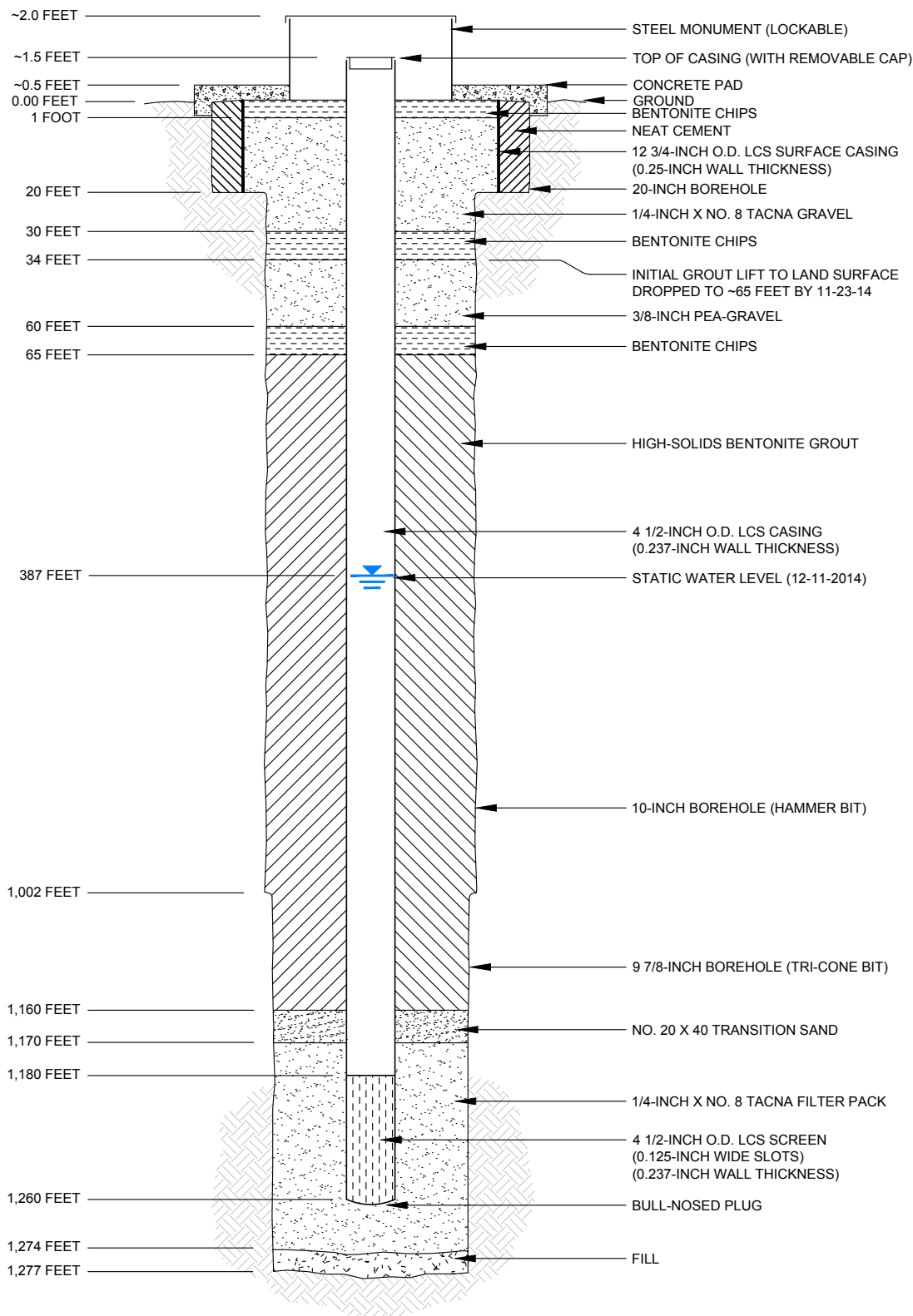


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-013 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 8

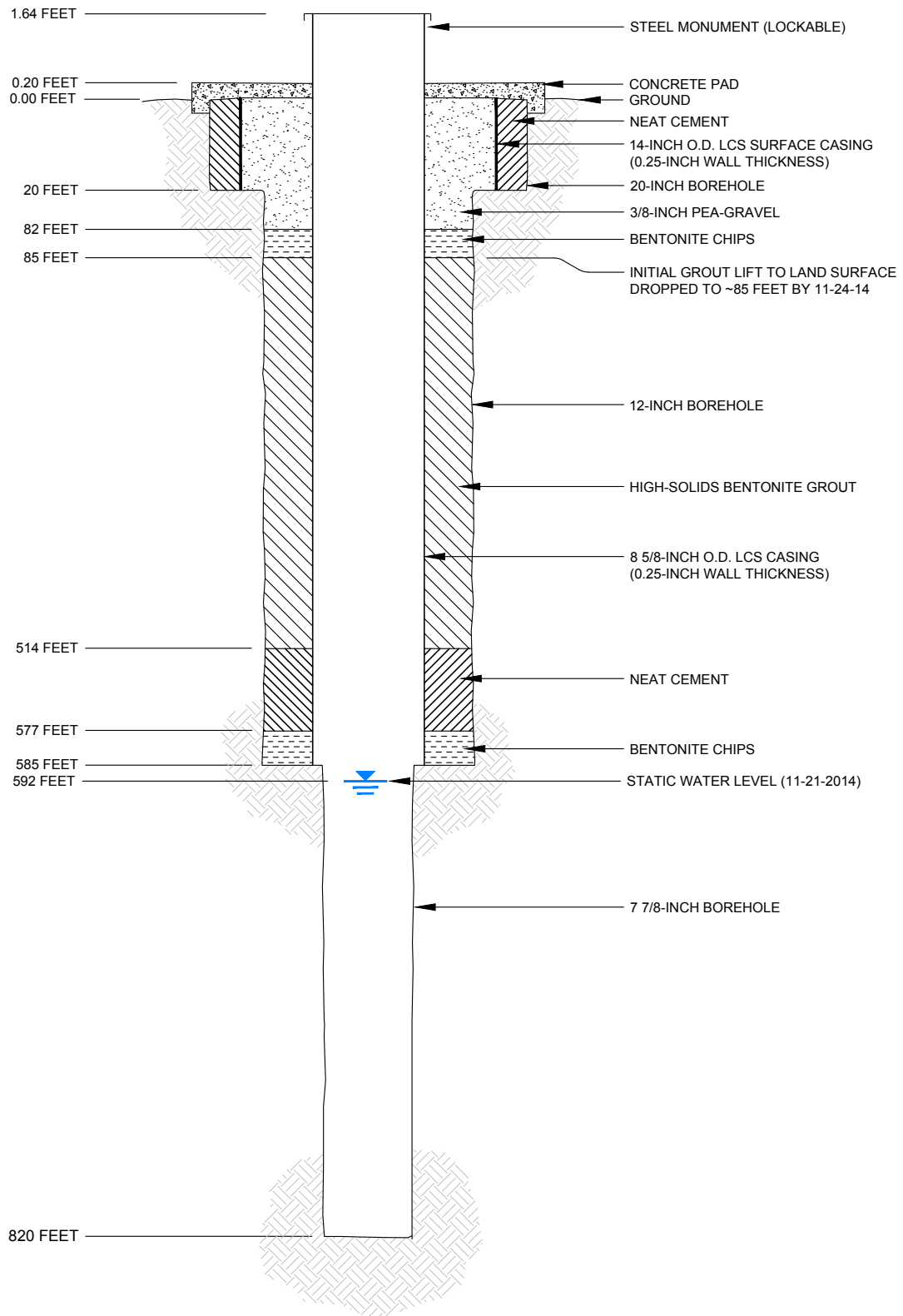


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-014B AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 9



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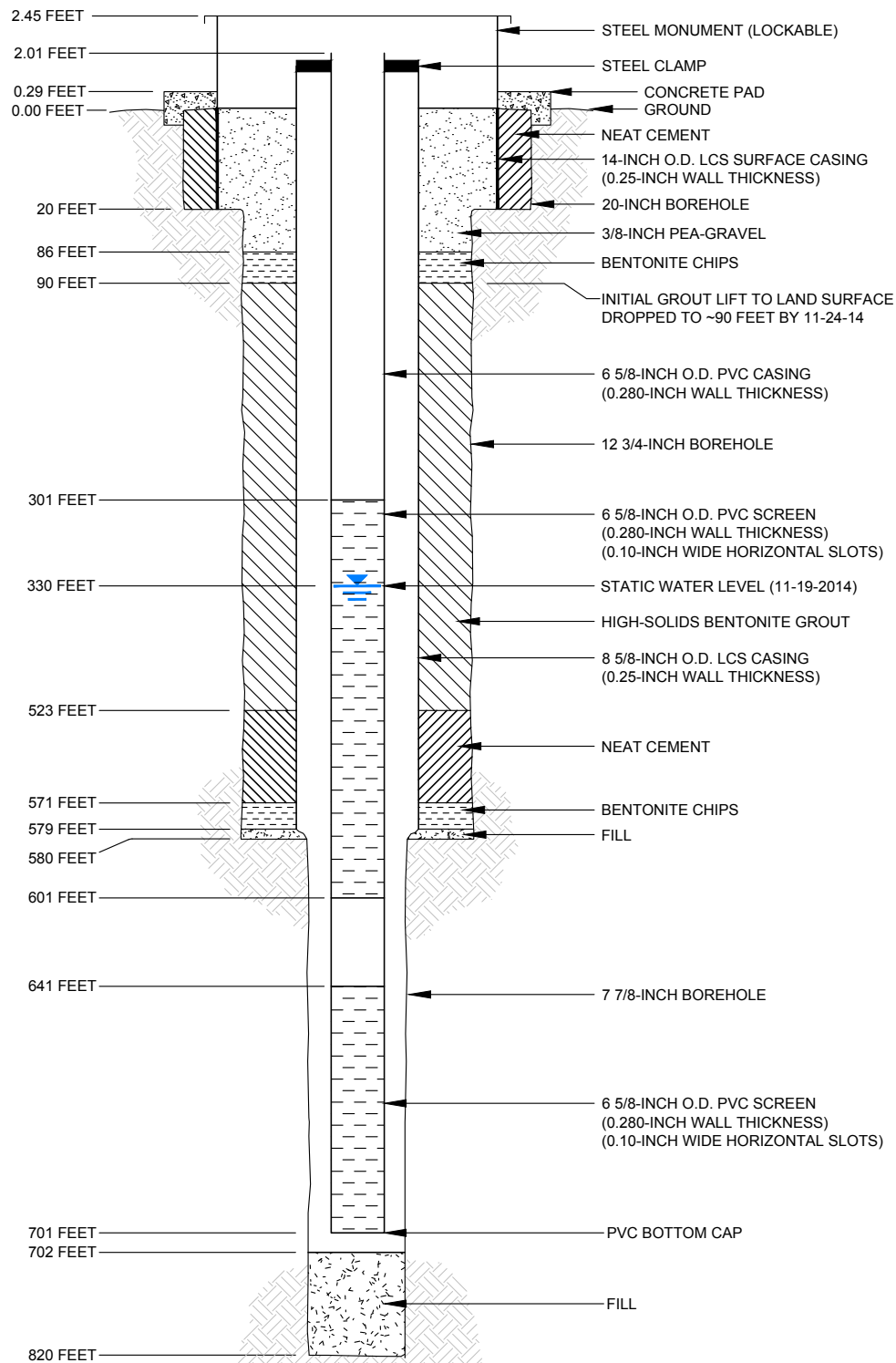
EXCELSIOR MINING CORPORATION  
 GUNNISON, ARIZONA

## NSH-015 AS-BUILT DIAGRAM

SCALE: NONE  
 JULY 2015

FIGURE 10

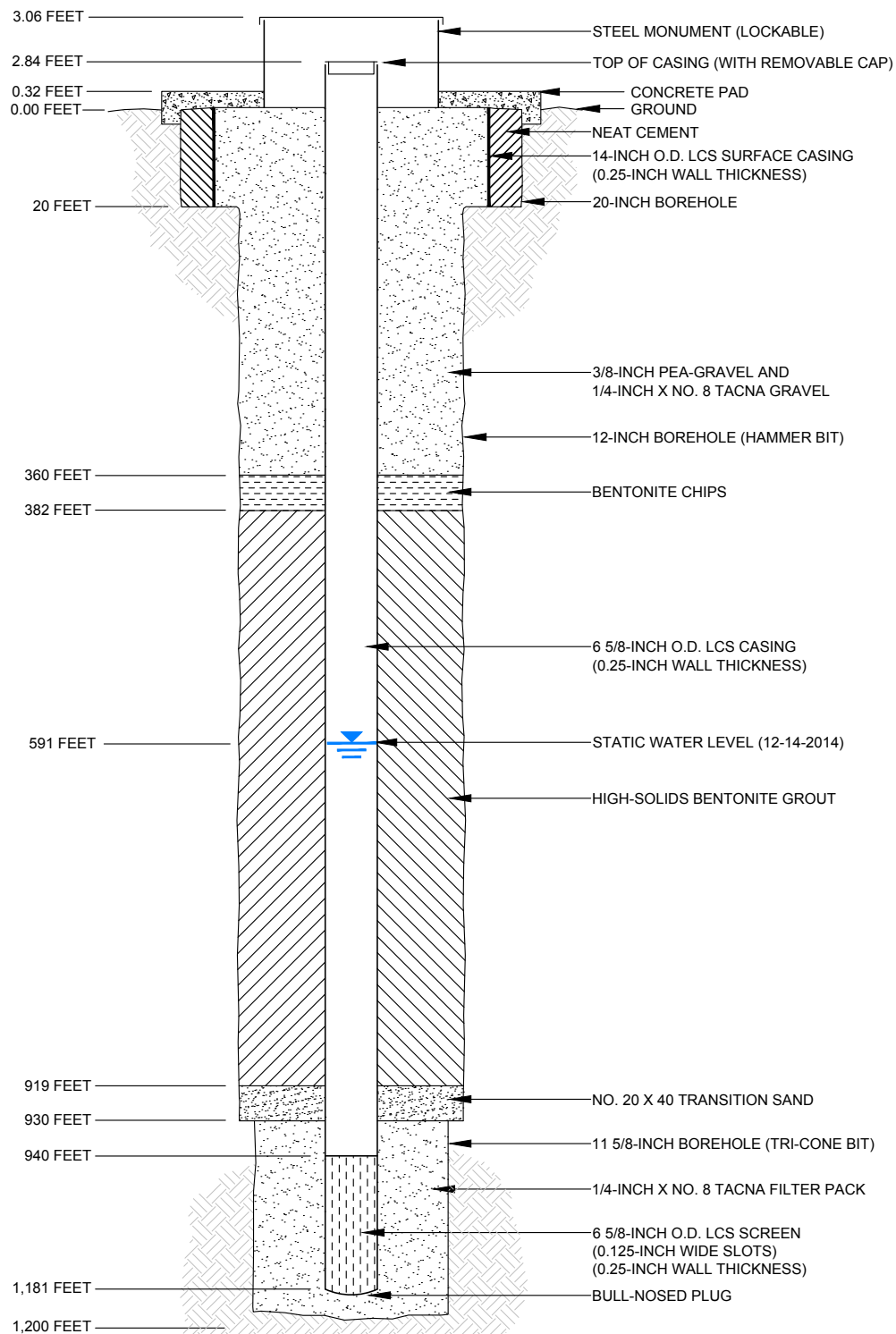




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## NSH-016 AS-BUILT DIAGRAM

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JULY 2015

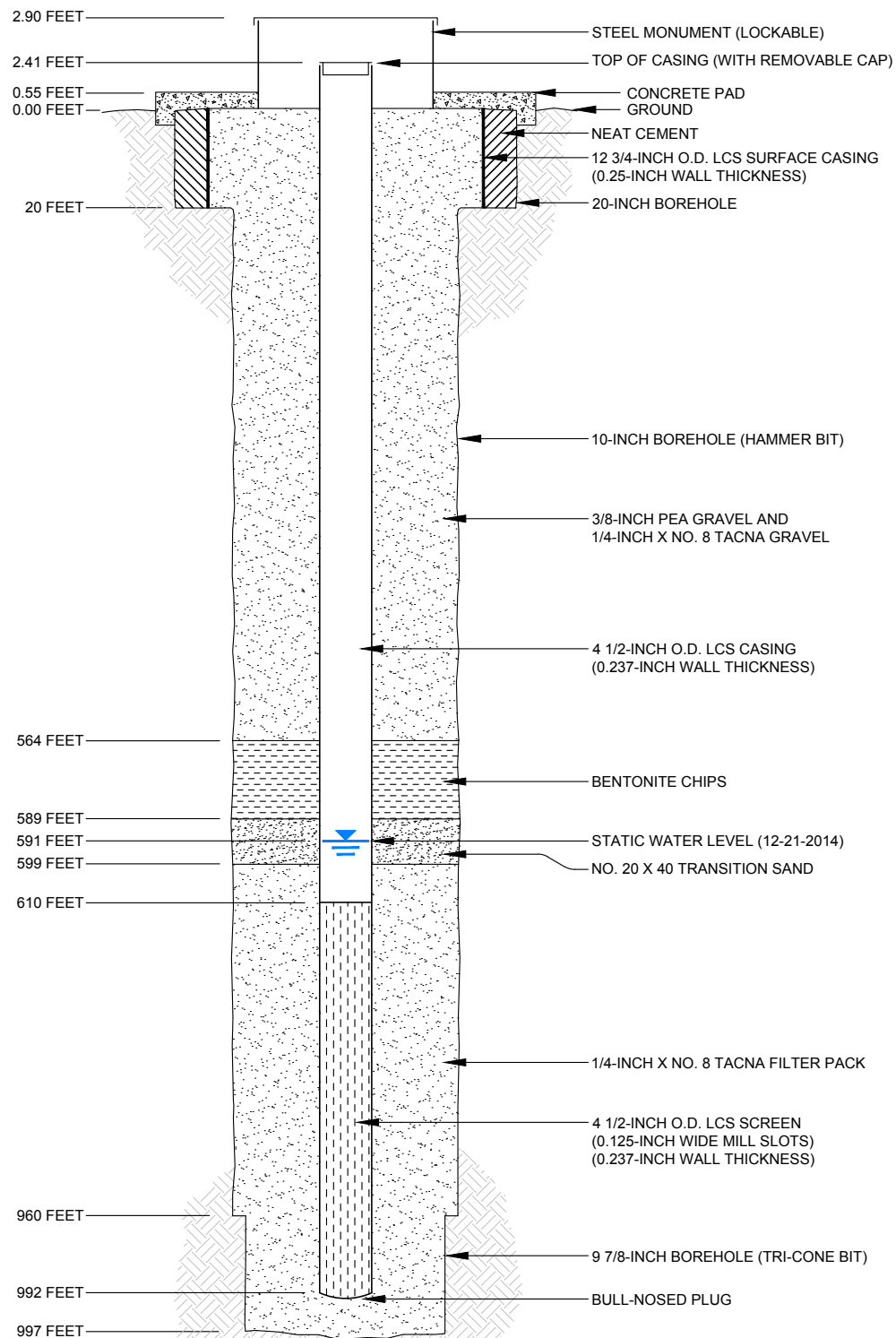


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## NSH-017 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 12

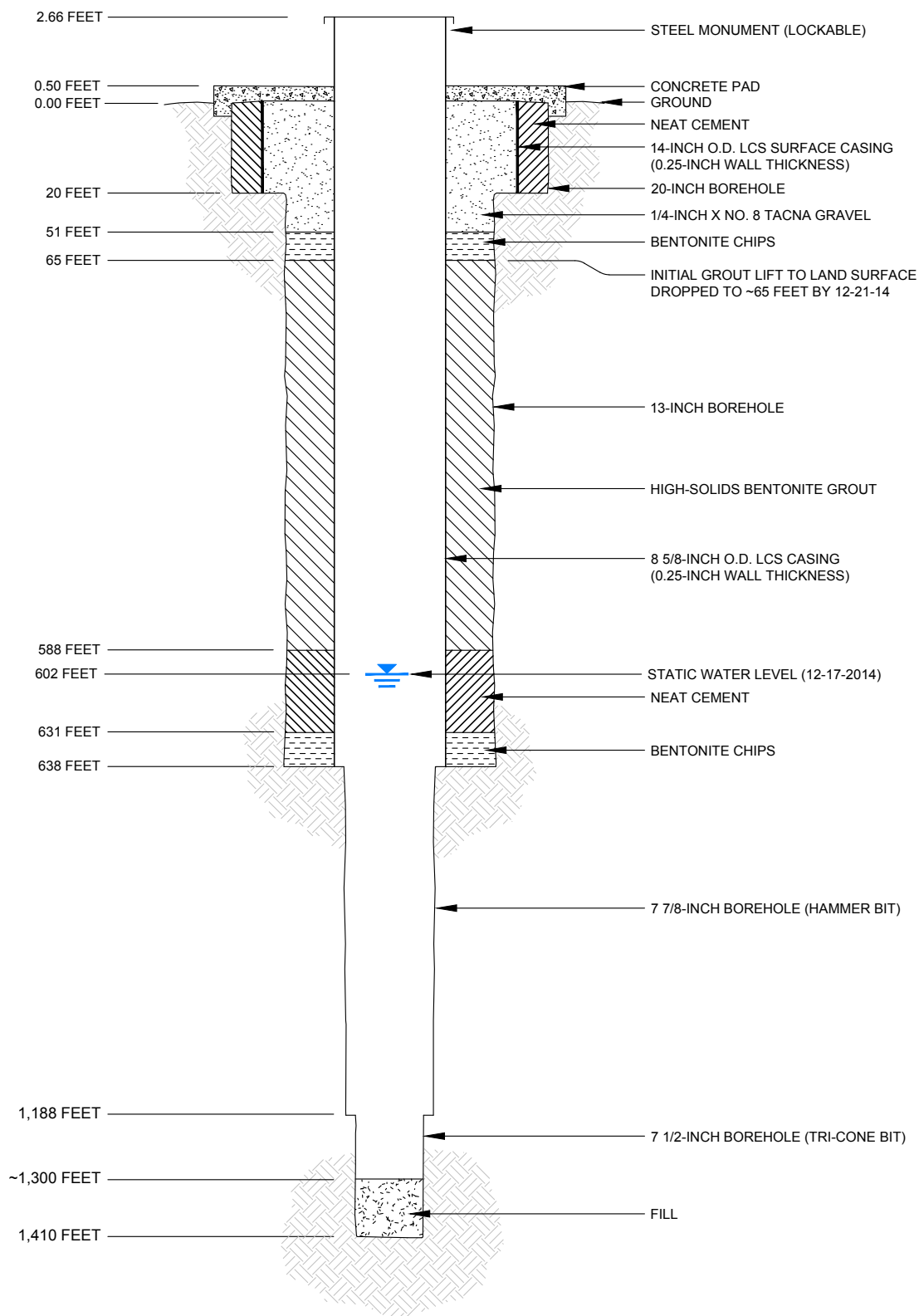


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GUNNISON, ARIZONA

## NSH-018 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 13

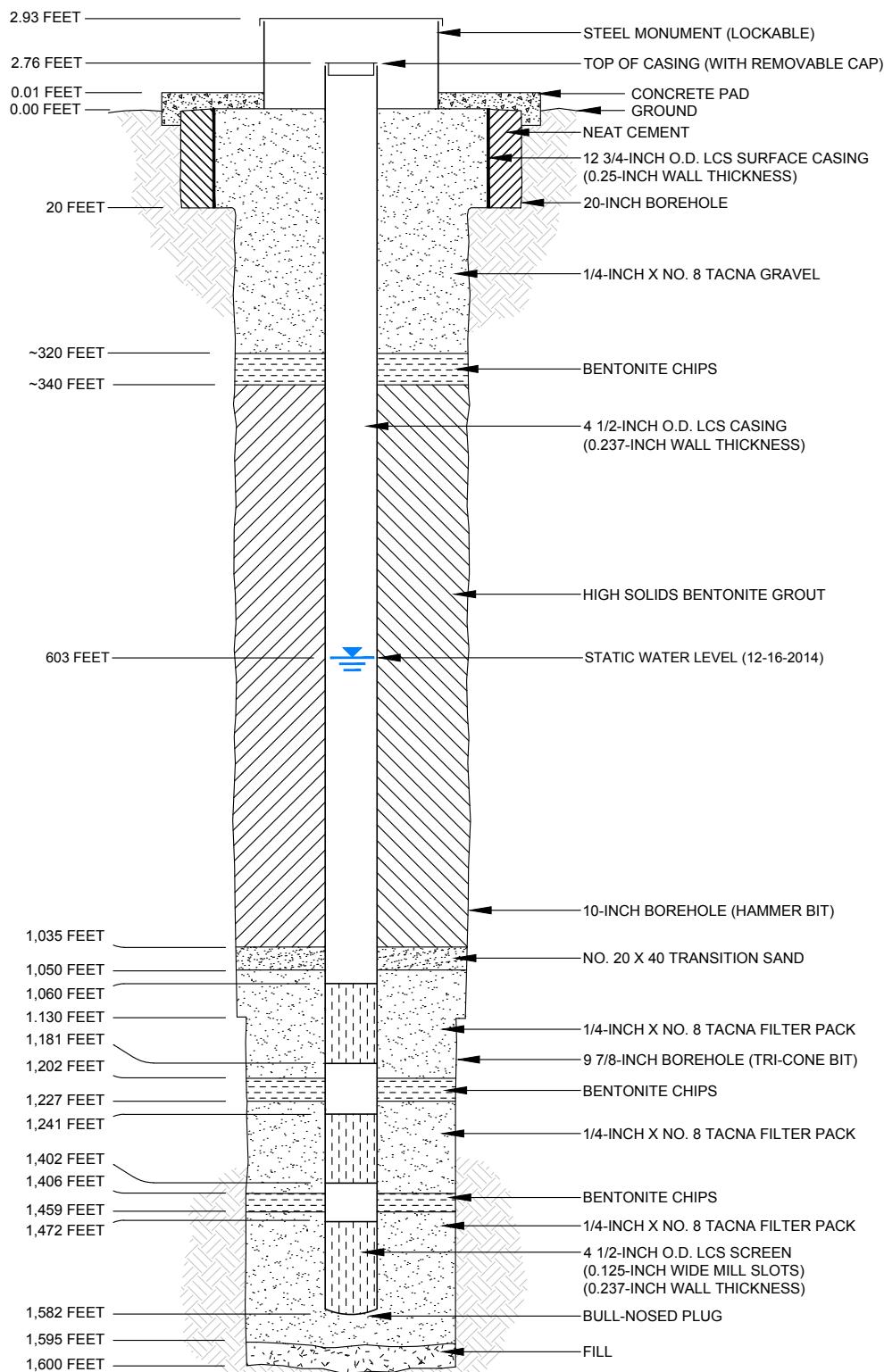


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-019 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 14



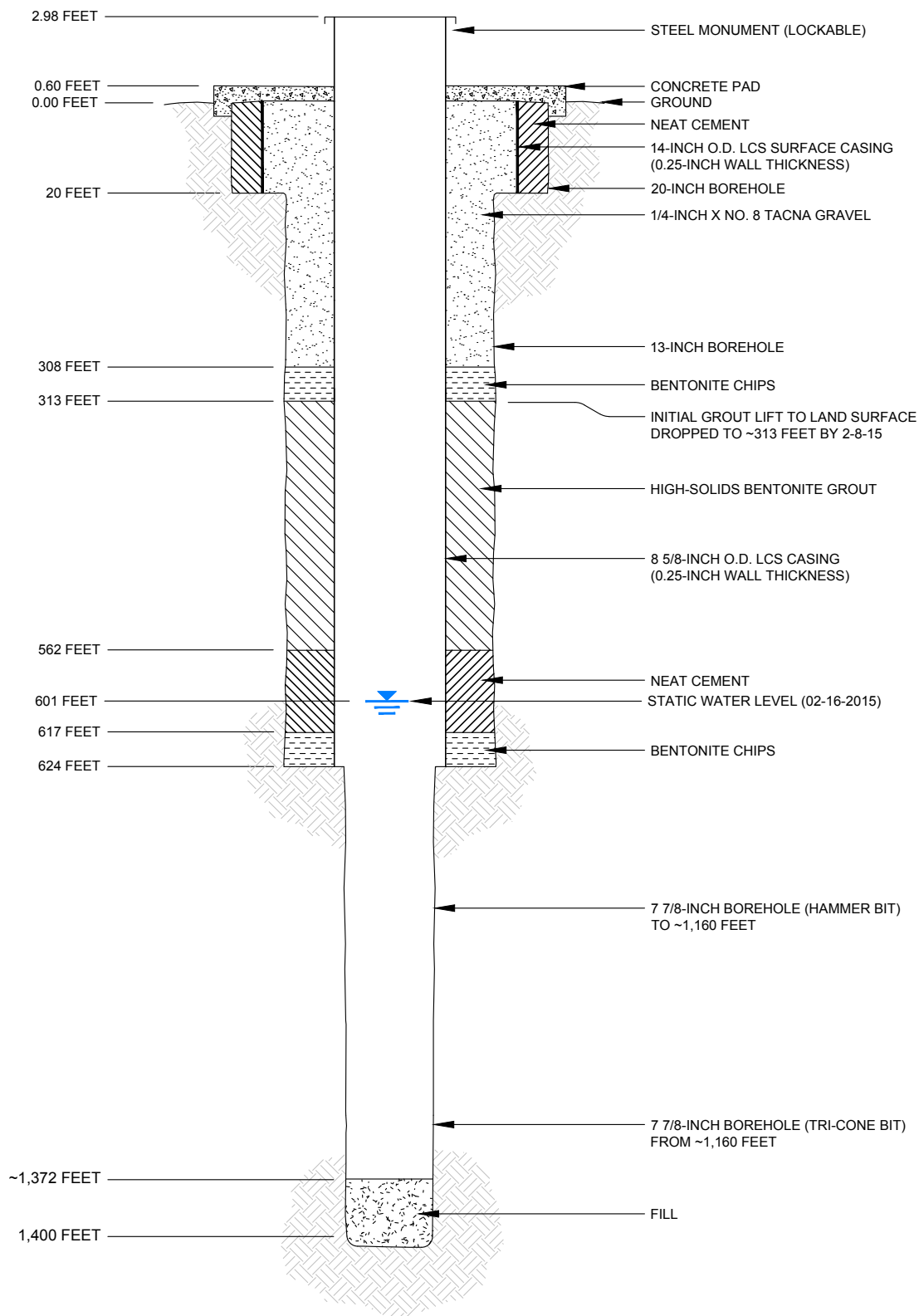
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EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-020 AS-BUILT WELL DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 15



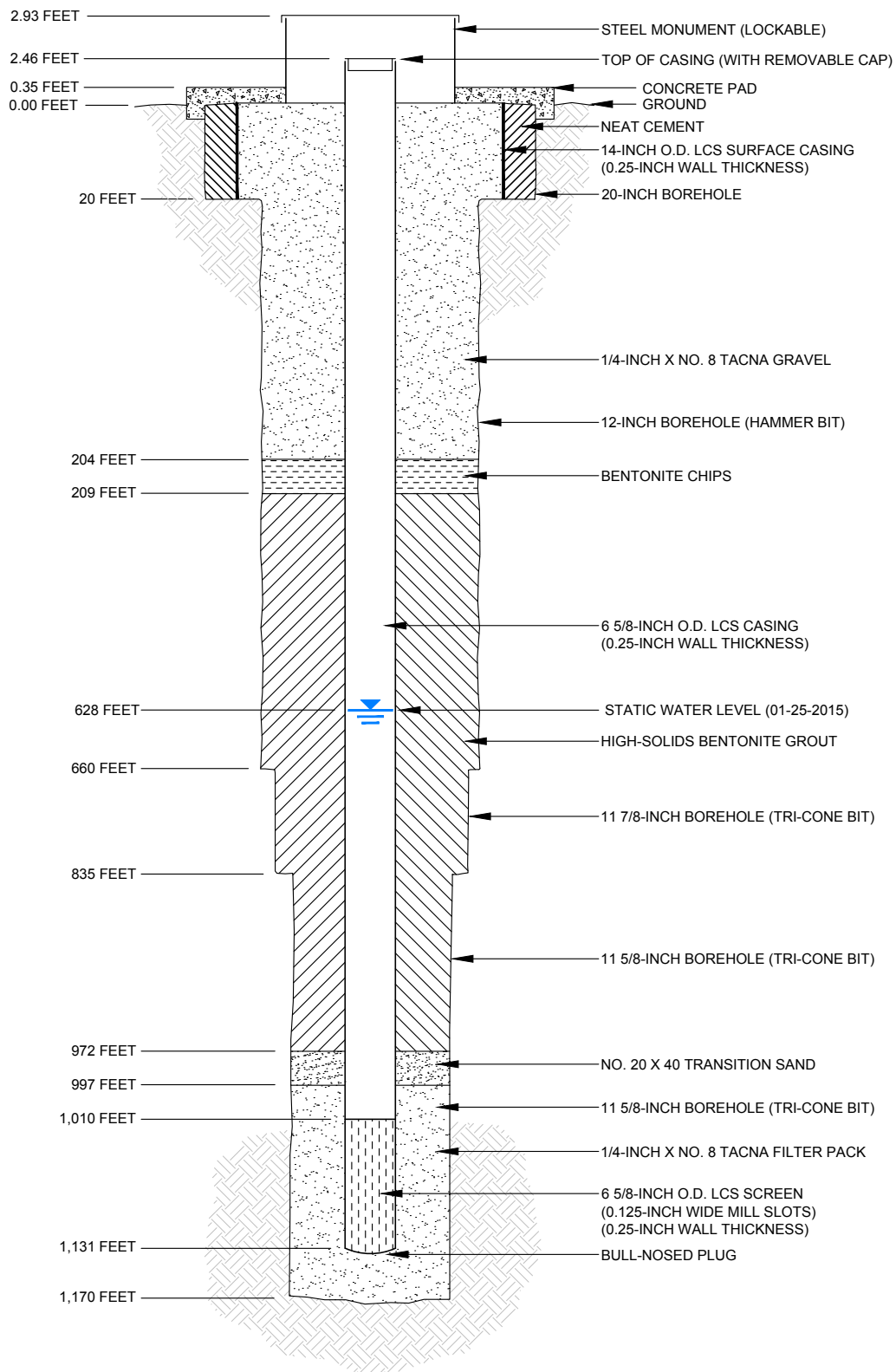
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GUNNISON, ARIZONA

## NSH-021C AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 16

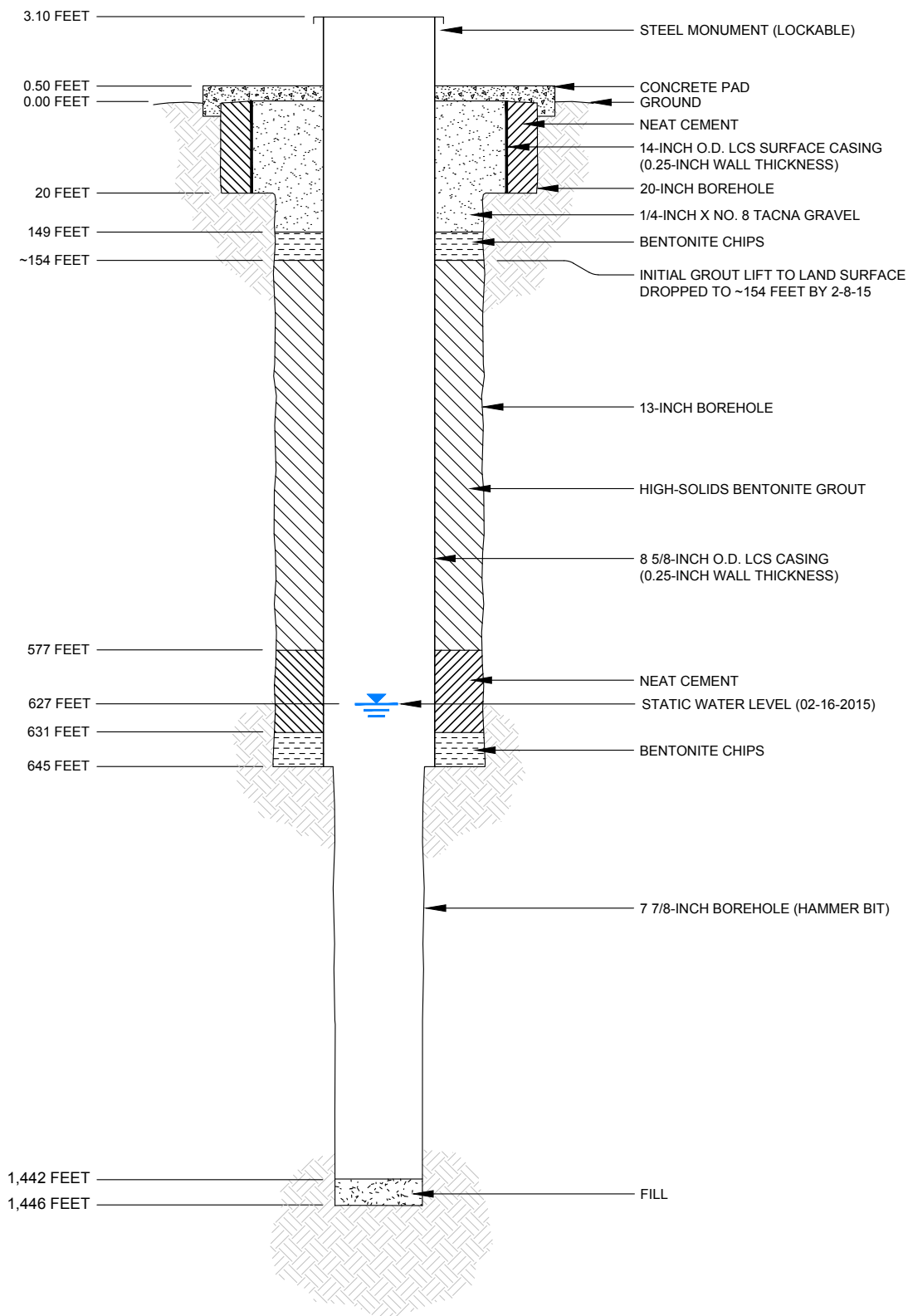


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GUNNISON, ARIZONA

## NSH-022 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 17



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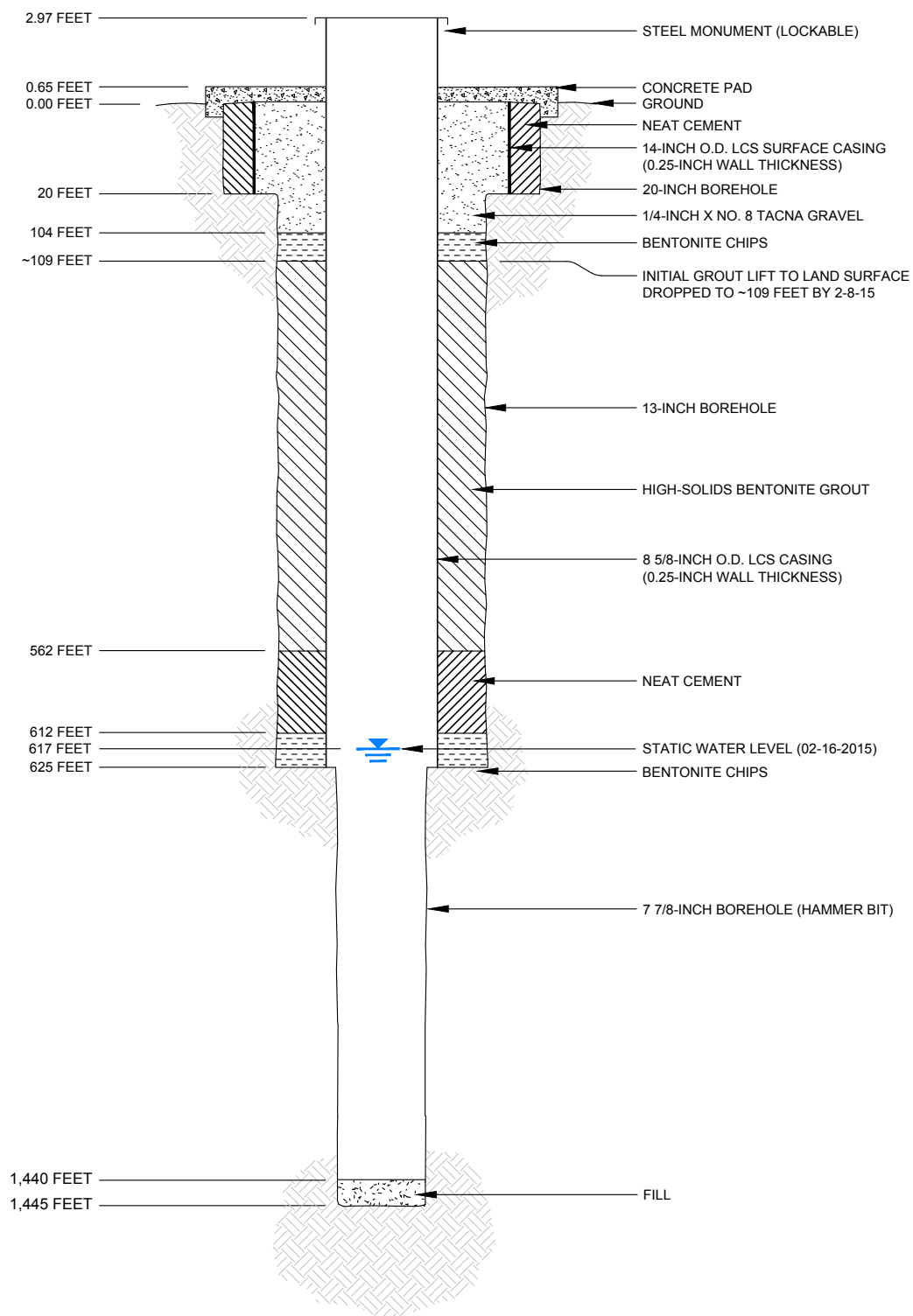
EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-023 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 18





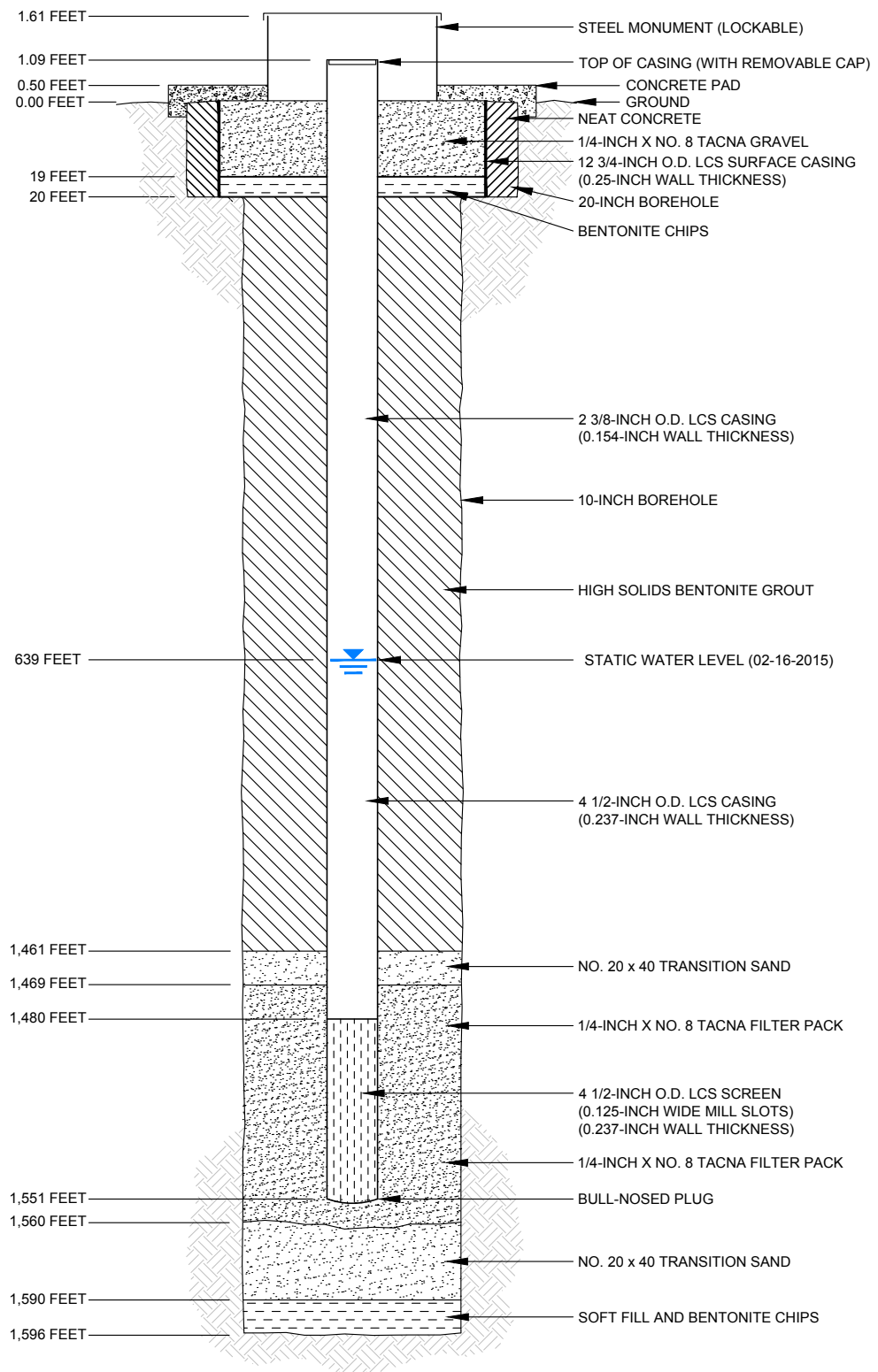
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GUNNISON, ARIZONA

## NSH-024 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 19

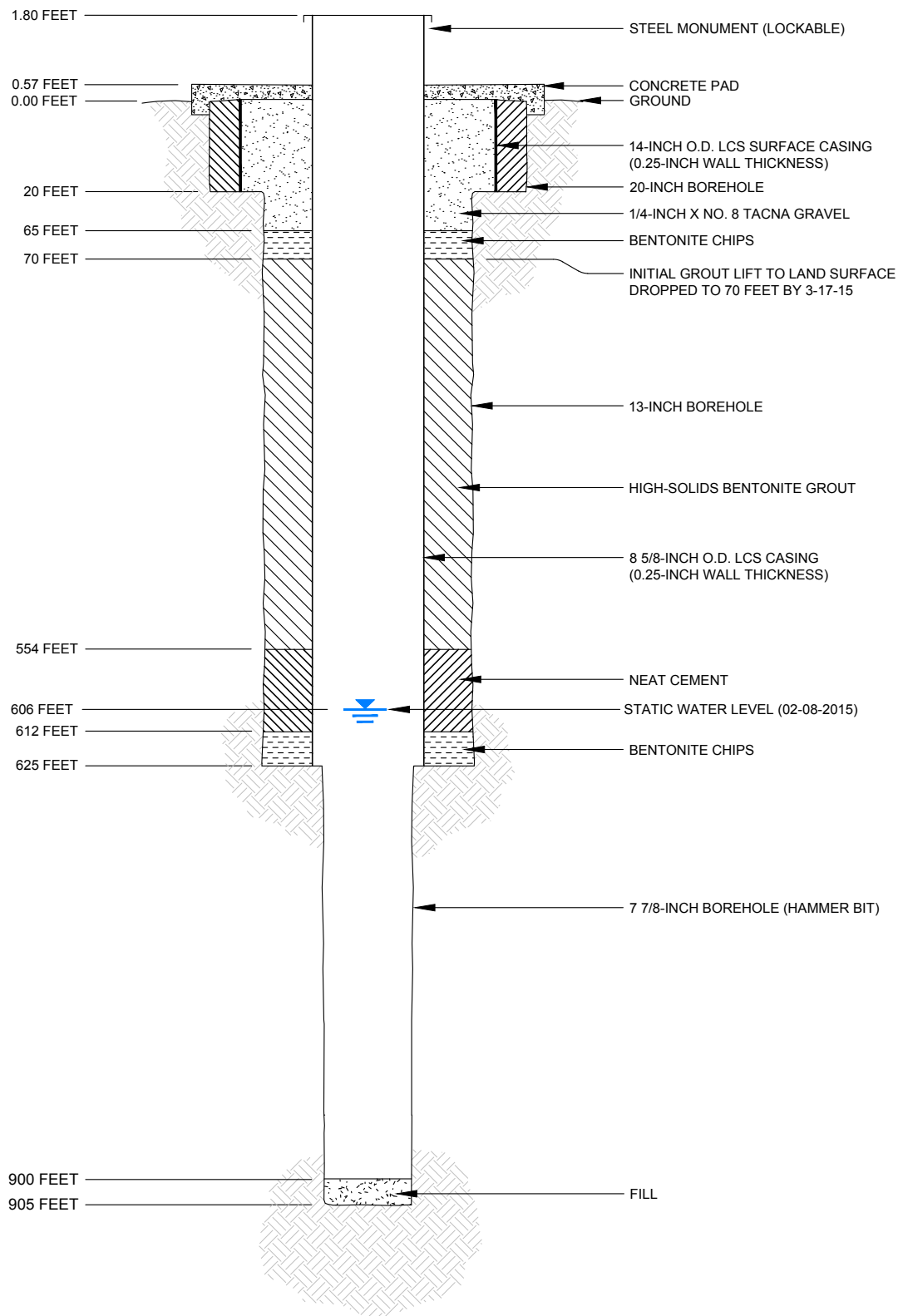


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-025 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 20



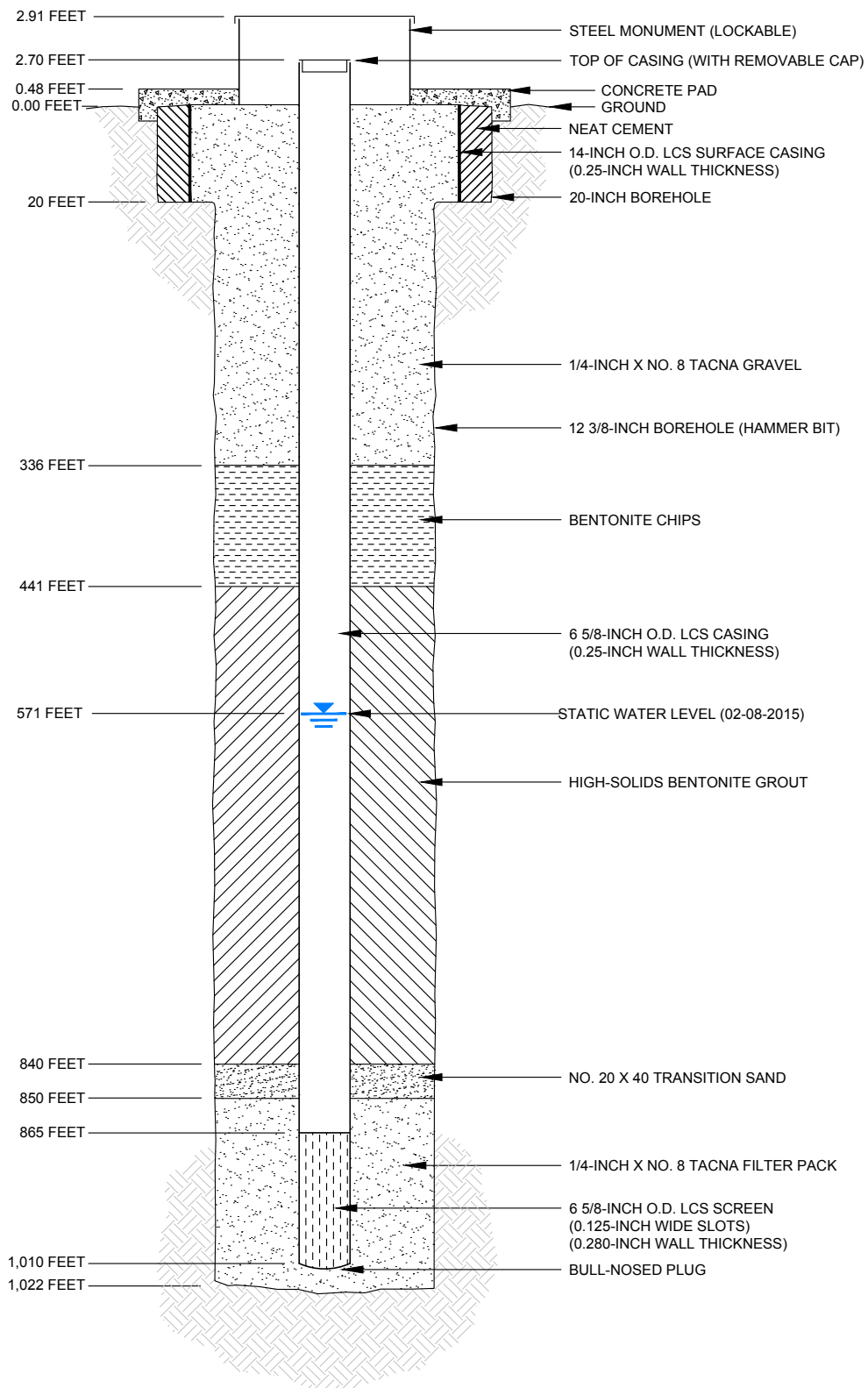
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EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-026 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 21

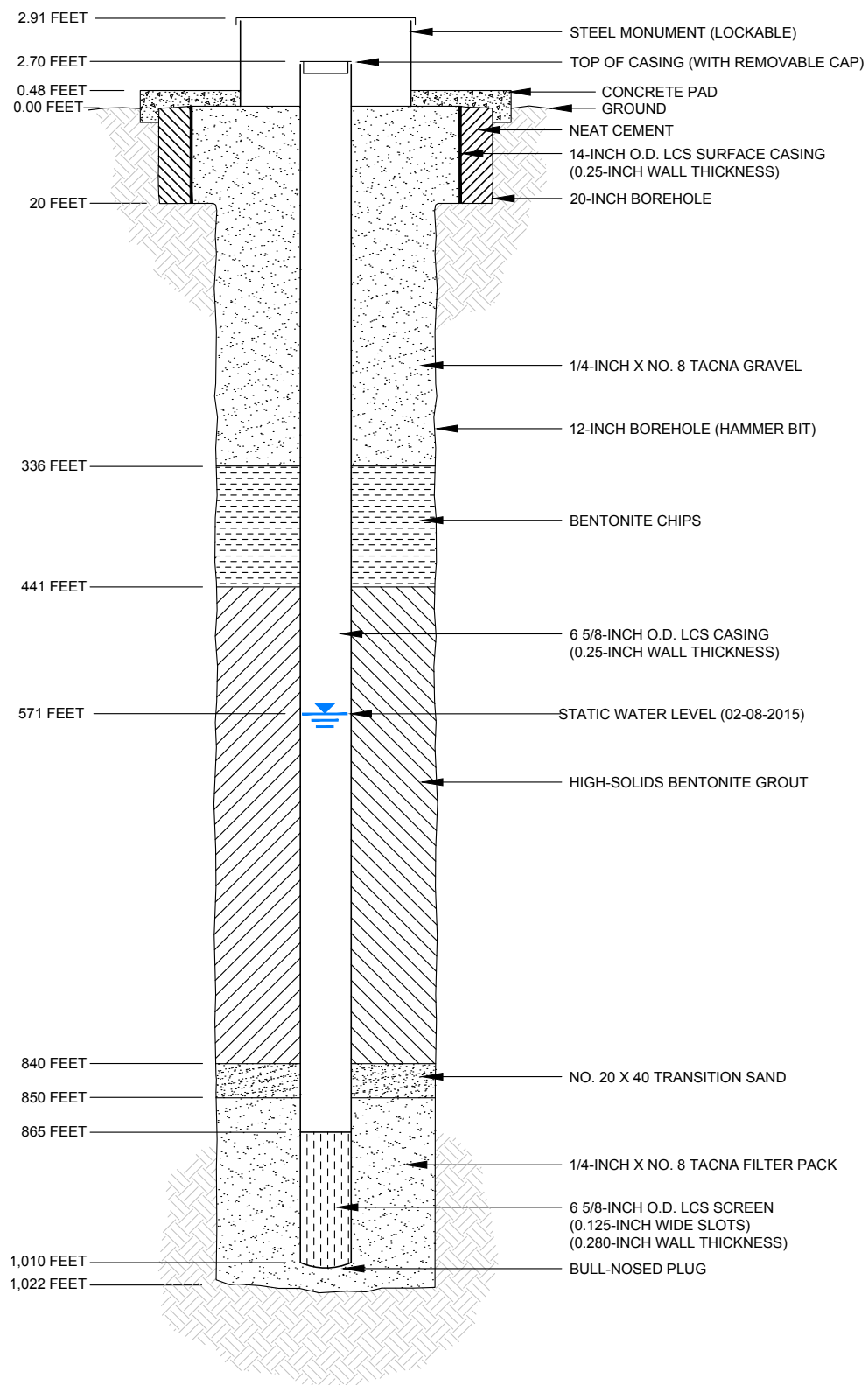


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

### NSH-027 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 22

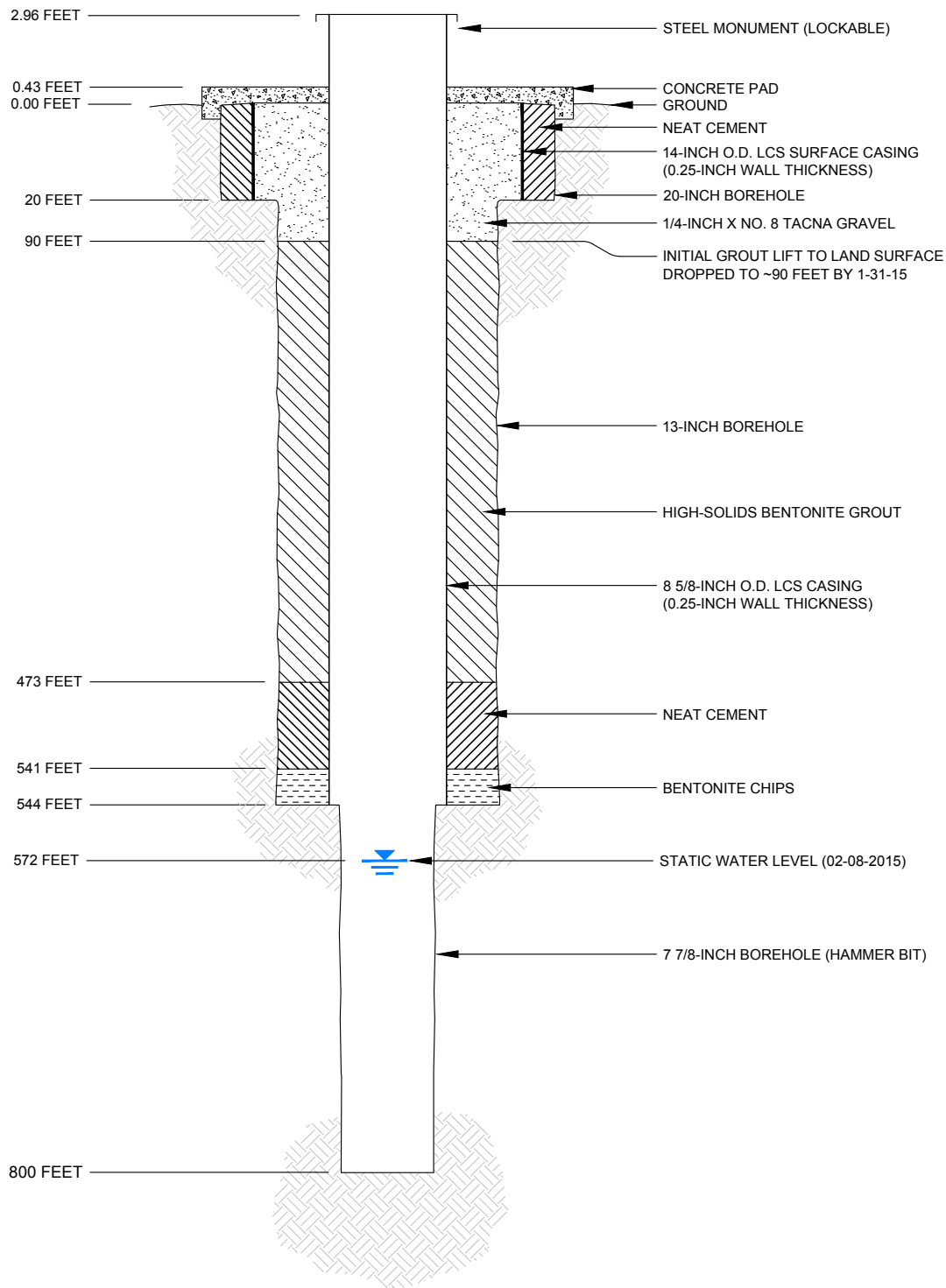


EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

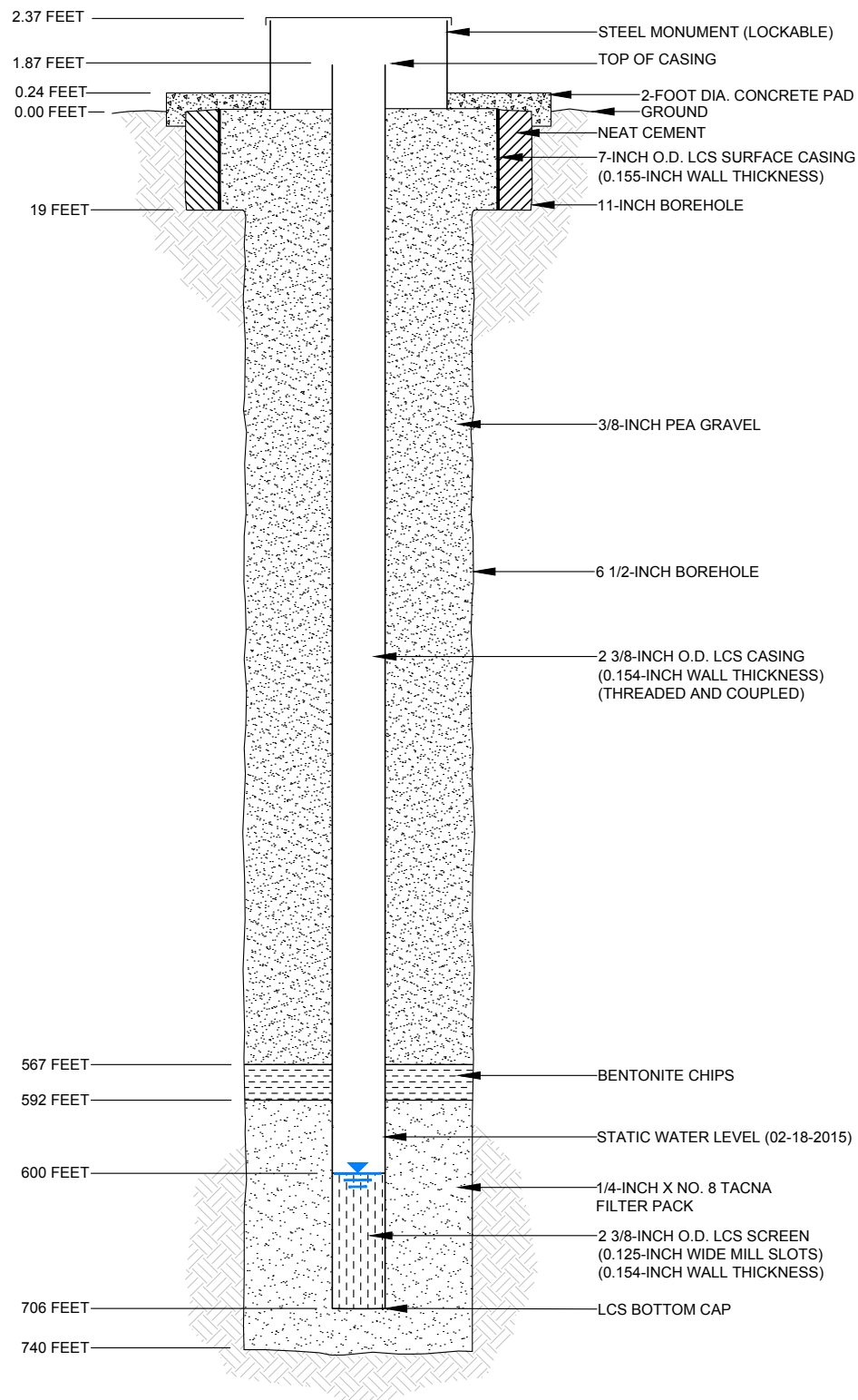
### NSH-027 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 22







**HALEY  
ALDRICH**

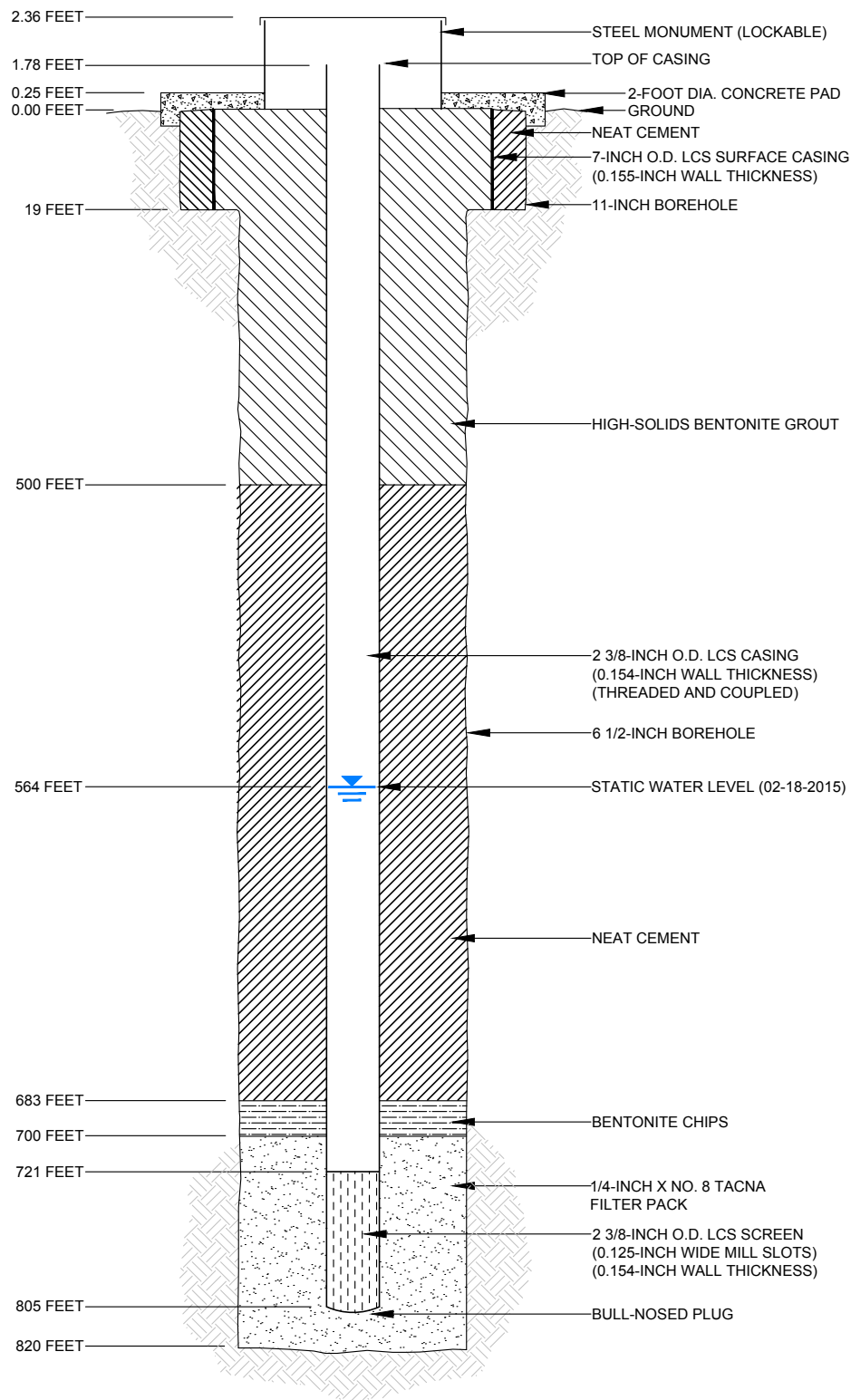
EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-030 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 25





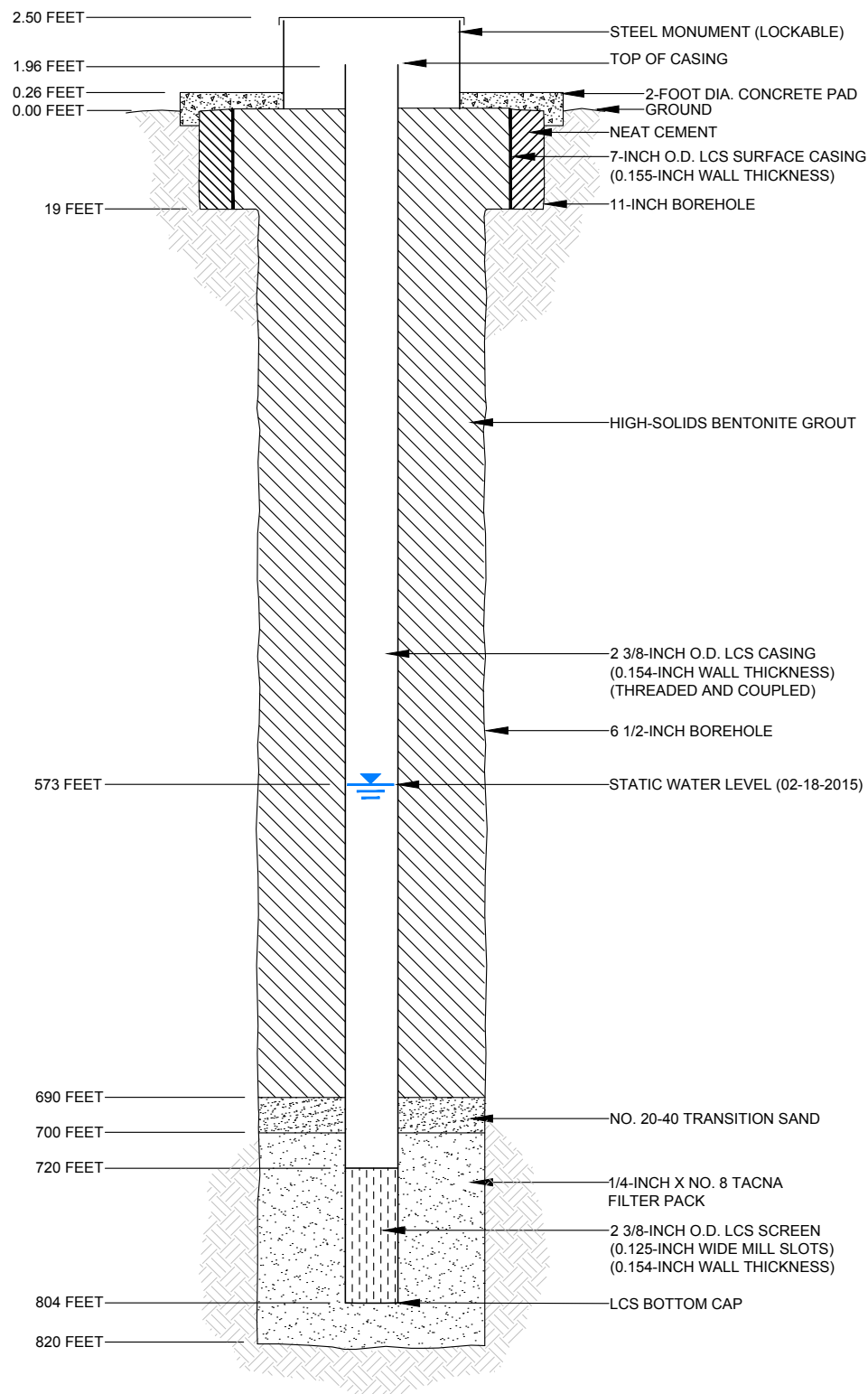
**HALEY  
ALDRICH**

EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-031 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 26



**HALEY  
ALDRICH**

EXCELSIOR MINING CORPORATION  
GUNNISON, ARIZONA

## NSH-032 AS-BUILT DIAGRAM

SCALE: NONE  
JULY 2015

FIGURE 27

## **APPENDIX A**

### **Lithology Logs**

# BORING LOG

Page 1 of 2

Project Excelsior		Hole ID NSH-007		Location NSH-CP	
Project Number 38361		Lithology Described by J. Cook		Date Started 10/16/14	Date Finished 10/23/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 330 feet (12/11/14)	
Drilling Method Air-rotary Hammer				Total Depth 620 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
CL, <u>Clay with Sand</u> (0 - 20 feet) Primarily silt and clay with ~15% fine to coarse sand and trace gravel to ~6 mm. The sand and gravel is subangular to subrounded. The fines have medium plasticity and toughness.		0 - 0	1.5	Strong	Drilled an 18-inch borehole with a tri-cone bit and reamer to 20 feet on 10-16-2014 and installed 14-inch low-carbon steel surface casing to 20 feet with a 20-foot cement-bentonite surface seal.  All depths are below land surface.  Commenced drilling with a 12-inch hammer bit on 10-17-2014.
		20 - 0	1.1		
		40 - 0	1.7		
SW, <u>Sand with Gravel</u> (20 - 130 feet) Primarily coarse to medium sand with ~25% gravel to ~25 mm. The sand and gravel is subangular to subrounded and is comprised of ~50% granite and ~50% lithics. This interval is generally referred to as mixed lithics.		60 - 0	1.0		
		80 - 0	0.6		
		100 - 0	0.9		
		120 - 0	0.5		
		140 - 0	0.6	Weak to strong	
SW, <u>Sand with Gravel</u> (130 - 320 feet) Primarily coarse to medium sand with ~20% gravel to ~25 mm and trace fines. The sand and gravel is subangular to subrounded, is comprised of ~85% granite and ~15% lithics, and reacts weakly with HCl. The fines react strongly to HCl.		160 - 0	0.7		
		180 - 0	0.6		
		200 - 0	0.5		
		220 - 0	0.6		
		240 - 0	0.7		
		260 - 0	0.7		
		280 - 0	0.8		
		0 - 0	0.7		

## BORING LOG

Project	Excelsior	Hole ID			NSH-007	Lithology Described by
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
SW, <u>Sand with Gravel</u> (130-320 feet)		- 300 -	1.75	Weak		
		- -	3.6			
		- 320 -	1.3			
Martin Formation (320 -470 feet) Primarily dolomite, light tan to white colored. Cuttings include magnetite and other iron oxides, as well as minor copper oxides.		- -	2.4			
		- 340 -	1.9			
		- -	2.3			
		- 360 -	1.6			
		- -	2.4			
		- 380 -	2.4			
		- -	2.4			
		- 400 -	1.95			
		- -	2.25			
		- 440 -	2.5			
		- -				
<u>Abrigo Formation</u> (470 - 620 feet) Primarily light to dark green colored metasediments. Commonly referred to as tactite. Cuttings include pyrite, chrysocolla, copper sulfides, fluorite, and iron oxides. Minor manganese oxides and garnet also present.		- 480 -	1.5	Weak		
		- -	1.4			
		- 500 -	0.85			
		- -	1.2			
		- 540 -	1.2			
		- -	0.8			
		- 560 -	0.8			
		- -	1.0			
		- 600 -				
		- 620 -				
		- -				

# BORING LOG

Project Excelsior	Hole ID NSH-008	Location NSH-CQ		
Project Number 38681	Lithology Described by B. Kienenberger	Date Started 10/24/14	Date Finished	
Drilling Company National EWP	Geophysical Logging Co. COLOG	Site Elevation 4790 feet		
Drilling Equipment GEFCO Speedstar 50K	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma	Water Level		
Drilling Method Air-rotary Hammer		Total Depth 900 feet		
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
CL, <u>Lean Clay with Sand</u> (0 - 30 feet)	0	0.55	Strong	
	20	4.5		
SC, <u>Clayey Sand</u> (30 - 70 feet)	40	0.65	Weak to strong	
	60	1.15		
SW, <u>Sand with Gravel</u> (70 - 310 feet)	80	0.75		
	100	1.1		
	120	1		
	140	1.05		
	160	1.6		
	180	1.35	Weak to medium	
	200	1.15		
	220	1.45		
	240	1.2		
	260	1.4		
	280	1.4		
		0.4		

Project Excelsior	Hole ID NSH-008			Location NSH-CQ
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (310 - 460 feet) Gray-colored dolomite/limestone mixed with magnetite-bearing tactite. Other minerals observed include copper oxides, iron oxides, and minor amounts of chrysocolla.	- 300 -			
	-	1.95		
	- 320 -			
	-	1.05		
	- 340 -			
	-	1.75		
	- 360 -			
	-	1.55		
	- 380 -		Strong	
	-	1.2		
	- 400 -			
	-	1.2		
<u>Upper Abrigo Formation</u> (460 - 560 feet) White and green-colored tremolite-actinolite tactite containing rhodochrosite, epidote, copper oxides, and iron oxides.	- 420 -			
	-	0.95		
	- 440 -			
	-	1.3		
	- 460 -			
	-	1.55		
	- 480 -			
<u>Middle Abrigo Formation</u> (560 - 740 feet) Brown-colored garnet-epidote tactite with minor amounts of rhodochrosite.	-	1.4		
	- 500 -		Weak to medium	
	-	1.05		
	- 520 -			
	-	1.1		
	- 540 -			
	-	1.3		
	- 560 -			
	-	1.55		
	- 580 -			
	-	2.55		
	- 600 -		Medium to strong	
	-	3.35		
	- 620 -			
	-	2.9		
	- 640 -			
	-	1.85		



# BORING LOG

Project Excelsior		Hole ID NSH-008			Location NSH-CQ	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
Middle Abrigo Formation (560 - 740 feet) Brown-colored garnet-epidote tactite with minor amounts of rhodochrosite.		660				
			1.5			
		680				
			3			
		700				
			4.55			
Lower Abrigo Formation (740 - 900 feet) Black-colored hornfels with abundant quartz veins. Other minerals observed include epidote, fluorite, pyrite, copper oxides, and iron oxides.		720		None		
			0.95			
		740				
			1.85			
		760				
			2.95			
		780				
			2.15			
		800				
			2.6			
		820				
			1.9			
		840			Total depth 900'	
			1.6			
		860				
			1.85			
		880				
			2.25			
		900				

# BORING LOG

Project Excelsior		Hole ID NSH-009		Location NSH-CS	
Project Number 38681		Lithology Described by C. Price		Date Started 10/30/14	Date Finished
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation 4750 feet	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer				Total Depth 1060 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
CL, <u>Sandy Lean Clay with Gravel</u> (0 - 20 feet)		0		Weak to medium	
ML, <u>Sandy Silt</u> (20 - 40 feet)		20		Medium	
SW-SM, <u>Sand with Silt and Gravel</u> (40 - 160 feet)		40	1.05	Strong	
		60	0.65		
		80	0.5		
		100	0.4		
		120	0.45		
		140	0.3		
		160	0.3		
ML, <u>Silt with Sand</u> (160 - 260 feet)		180	0.3		
		200	0.6		
		220	0.35		
		240	0.45		
		260	0.6		
SW-SM, <u>Sand with Silt and Gravel</u> (260-480 feet)		280	0.4		
			0.4		
			0.4		
			0.4		
			0.4		
			0.4		
			0.4		

# BORING LOG

Project Excelsior	Hole ID NSH-009			Location NSH-CS
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SW-SM, <u>Sand with Silt and Gravel</u> (260-480 feet)	300	0.6		
	320	0.6		
	340	0.7		
	360	0.6		
	380	0.8		
	400	0.7		
	420	1.2		
	440	1.2		
	460	1.5		
	480	1.6		
<u>Escabrosa Formation</u> (480-520 feet) White-colored marble containing minor iron oxides.	500	1.2		
	520	1.5		
<u>Martin Formation</u> (520-660 feet) Gray and white-colored dolomite and limestone mixed with magnetite-bearing tactite. Other minerals present include minor amounts of chrysocolla, rhodochrosite, serpentine, iron oxides and manganese oxides.	540	1.4		
	560	0.6		
	580	2.4		
	600	2.2		
	620	1		
	640	1.1		

Project Excelsior	Hole ID NSH-009			Location NSH-CS
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation (660-790 feet)</u> Green-colored amphibole-chlorite tactite/hornfels with rhodochrosite, magnetite, garnet, iron oxides, and manganese oxides.	660			
		1.5		
	680			
		0.9		
	700			
		0.8		
	720			
		0.8		
	740			
		1.2		
<u>Middle Abrigo Formation (790-1000 feet)</u> Brown-colored garnet-epidote tactite with minor amounts of grossularite and fluorite.	760			
		1.3		
	780			
		1.5		
	800			
		1.6		
	820			
		3.3		
	840			
		3.2		
	860			
		4.5		
	880			
		4.1		
	900			
		5.3		
	920			
		5.2		
	940			
		4.4		
	960			
		2.7		
	980			
		3.1		
	1000			
		4		

Project Excelsior	Hole ID NSH-009			Location NSH-CS
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
Lower Abrigo Formation (1000-1060 feet) Black-colored hornfels with abundant quartz veins and minor iron oxides.	1020			
		1.9		
	1040	2		
	1060			Total Depth 1060'
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			
	-			

# BORING LOG

Project Excelsior		Hole ID NSH-010		Location NSH-CT	
Project Number 38681		Lithology Described by D. Andersen, C. Barnes		Date Started 10/30/14	Date Finished 11/3/2014
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation 4760 feet	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer				Total Depth 720 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
CL, <u>Sandy Lean Clay with Gravel</u> (0 - 10 feet)		0		Strong	
SM, <u>Silty Sand with Gravel</u> (10 - 40 feet)		20		Weak	
SP-SM, <u>Sand with Silt and Gravel</u> (40 - 70 feet)		40	0.6	Strong	
SW, <u>Sand with Gravel</u> (70 - 180 feet)		60	0.55	Weak	
		80	0.55		
		100	0.5		
		120	0.55		
		140			
		160	0.6		
		180	0.7		
		200	0.6		
SM, <u>Silty Sand</u> (180 - 230 feet)		220	0.8		
SW-SM, <u>Sand with Silt</u> (230-400 feet)		240	0.95		
		260	0.65		
		280	1.15		
			0.4		

# BORING LOG

Page 2 of 3

Project Excelsior	Hole ID NSH-010			Location NSH-CT
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SW-SM, <u>Sand with Silt</u> (230-400 feet)	300		Weak	
		1.05		
	320			
		1.4		
	340			
		1.95		
	360			
		0.85		
380				
	1.15			
SP-SM, <u>Sand with Silt</u> (400 - 490 feet)	400			
		1.8		
	420			
		1.2		
	440			
		1.35		
	460			
		2.25		
<u>Escabrosa Formation</u> (490 - 610 feet) White-colored marble with minor garnetite.	480			
		1.3		
	500			
		1.05		
	520			
		1		
	540			
		1.45		
	560			
		0.9		
<u>Martin Formation</u> (610 - 720 feet) Gray-colored dolomite/limestone mixed with magnetite-bearing tactite. Other minerals observed include epidote, cuprite, fluorite, chrysocolla, rhodocrosite, copper oxides, manganese oxides and iron oxides.	580			
		0.9		
	600			
		0.6		
	620			
		1.2		
	640			
	1.75			



## BORING LOG

Project	Excelsior	Hole ID			NSH-010	Location	NSH-CT
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks		
<u>Martin Formation</u> (610 - 720 feet) Gray-colored dolomite/limestone mixed with magnetite-bearing tactite. Other minerals observed include epidote, cuprite, fluorite, chrysocolla, rhodocrosite, copper oxides, manganese oxides and iron oxides.		- 660 -			Total Depth 720'		
		- -	1.5				
		- 680 -	1.3				
		- 700 -	1.4				
		- 720 -					

# BORING LOG

Project Excelsior	Hole ID NSH-012		Location NSH-CU	
Project Number 38681	Lithology Described by C. Barnes		Date Started 11/8/14	Date Finished 11/10/14
Drilling Company National EWP	Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment GEFCO Speedstar 50K	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 504 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
GW-GM, <u>Gravel with Silt and Sand</u> (0 - 40 feet)	0		Strong	
	20			
	40			
SW-SM, <u>Sand with Silt and Gravel</u> (40 - 160 feet)		0.5	Strong	
	60	0.8		
	80	0.6		
	100	0.7		
	120	0.8		
	140			
	160	0.6		
GW, <u>Gravel with Sand</u> (160 - 502 feet)	180	0.5	Weak to medium	
	200	0.8		
	220	0.9		
	240	0.5		
	260	0.4		
	280	0.3		
		0.4		

# BORING LOG

Project Excelsior		Hole ID NSH-012		Location NSH-CU	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
GW, <u>Gravel with Sand</u> (160 - 502 feet)	300	0.5		Total Depth 504'	
	320	0.35			
	340	0.85			
	360	0.45			
	380	0.8			
	400	0.85			
	420	2			
	440	1.3			
	460	1.75			
	480	1.1			
	500				
		0.35	Strong		
	520				
Escabrosa Formation (502-504 feet) White-colored marble with mixed garnetite.					

# BORING LOG

Project Excelsior		Hole ID NSH-013		Location NSH-CJ	
Project Number 38361		Lithology Described by C. Barnes		Date Started 11/3/14	Date Finished 11/7/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 654.66 feet (12/19/2014)	
Drilling Method Air-rotary Hammer				Total Depth 1070 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
GP-GC, <u>Poorly-graded Gravel with Clay and Sand</u> (0 - 600 feet)		0			
		20			
		40			
		60	2		
		80	0.6		
		100	0.65		
		120	0.65		
		140	0.7		
		160	0.7		
		180	0.7		
		200	0.9		
		220	1.4		
		240	0.9		
		260	0.85		
		280	0.85		

# BORING LOG

Project Excelsior		Hole ID NSH-013			Location NSH-CJ	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
GP-GC, <u>Poorly-graded Gravel with Clay and Sand</u> (0 - 600 feet)		- 300 -	1.05			
		- 320 -	0.55			
		- 340 -	0.75			
		- 360 -	1.1			
		- 380 -	0.9			
		- 400 -	1.2			
		- 420 -	1.2			
		- 440 -	0.9			
		- 460 -				
		- 480 -				
		- 500 -				
		- 520 -				
		- 540 -	0.6			
		- 560 -	0.7			
		- 580 -	0.8			
		- 600 -	1			
<u>Martin Formation</u> (600 - 800 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite.		- 620 -	1.8			
		- 640 -	2.35			
		- -				

Project Excelsior	Hole ID NSH-013			Location NSH-CJ
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation (600 - 800 feet)</u> Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite.	660			
	-	1.1		
	680			
	-	1.15		
	700			
	-	1.1		
	720			
	-	1.15		
	740			
	-	1.5		
<u>Escabrosa Formation (800 - 840 feet)</u> Gray-green colored amphibole tactite/hornfels with minor amounts of iron oxides and manganese oxides.	760			
	-	1.3		
	780			
	-			
<u>Martin Formation (840 - 950 feet)</u> Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite, with moderate amounts of copper oxides and iron oxides.	800			
	-	1.2		
	820			
	-	1.5		
	840			
	-	1.4		
	860			
	-	1.1		
	880			
	-	1.8		
<u>Texas Canyon Formation (950 - 1000 feet)</u> Cream-white colored quartz monzonite with minor amounts of iron oxides and potassic alteration.	900			
	-	1.6		
	920			
	-	1.7		
	940			
	-	1.3		
	960			
	-	1.5		
	980			
	-	1.5		
	1000			
	-	1.6		

Project Excelsior		Hole ID NSH-013			Location NSH-CJ
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
Martin Formation (1000 - 1050 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite, with minor amounts of copper oxides and iron oxides.	- 1020 -			Total Depth 1070'	
	- -	2.1			
Texas Canyon Formation (1050 - 1060 feet) Cream-white colored quartz monzonite with minor amounts of iron oxides and potassic alteration.	- 1040 -	1.8			
	- 1060 -	1.6			
Martin Formation (1060 - 1070 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite, with minor amounts of iron oxides.					



# BORING LOG

Project Excelsior	Hole ID NSH-014B	Location NSH-DN		
Project Number 38361	Lithology Described by C. Barnes	Date Started	Date Finished 11/19/14	
Drilling Company National EWP	Geophysical Logging Co. COLOG	Site Elevation		
Drilling Equipment 685K	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma	Water Level		
Drilling Method Air-rotary Hammer		Total Depth 1277 feet		
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
GC, <u>Clayey Gravel with Sand</u> (0 - 50 feet)	0	2.2	Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 10" hammer 20-997 ft. 9 7/8" ticone 997-1277 ft.
	20	0.7		
	40	0.5		
GW, <u>Gravel with Sand</u> (50 - 490 feet)	60	0.2	Medium to strong	
	80	0.3		
	100	0.3		
	120	0.6		
	140	0.75		
	160	0.5		
	180	0.5		
	200	0.3		
	220	0.3		
	240	0.3		
	260	1.3		
	280	0.3		
	0.4			

# BORING LOG

Project Excelsior	Hole ID NSH-014B			Location NSH-DN
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
GW, <u>Gravel with Sand</u> (50 - 490 feet)	300			
	-	0.4		
	320			
	-	0.4		
	340			
	-	0.5		
	360			
	-	0.4		
	380			
	-			
	400			
	-			
	420			
	-			
<u>Martin Formation</u> (490 - 645 feet) Gray-colored dolomite/limestone mixed with magnetite-bearing tactite. Other minerals observed include copper oxides, manganese oxides, and iron oxides.	440		Medium to strong	
	-	1.1		
	460			
	-	1.4		
	480			
	-	1.2		
	500			
	-	0.9		
	520			
	-	1.3		
	540			
	-	1.75		
	560			
	-	1.6		
	580			
	-	2		
	600			
	-	1.9		
	620			
	-	1.1		
	640			
	-	1.4		
	-			

# BORING LOG

Project Excelsior		Hole ID NSH-014B			Location NSH-DN				
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks				
<u>Upper Abrigo Formation</u> (645 - 960 feet) Green-colored amphibole-chlorite tactite/hornfels. Other minerals observed include epidote, rhodochrosite, copper oxides, and iron oxides.		660		Weak to medium					
			0.9						
		680	1.45						
		700	2.85						
		720	1.95						
		740	1.95						
		760	2.3						
		780							
		800	3.6						
		820	2.6						
		840	2.6						
		860	2.8						
		880	2.8						
		900	2.9						
		920	2.8						
		940							
		960							
		<u>Middle Abrigo Formation</u> (960 - 1000 feet) Brown-colored garnet-epidote tactite.						2.9	Strong
							980	3	
							1000	23.4	

# BORING LOG

Project Excelsior		Hole ID NSH-014B		Location NSH-DN	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
Lower Abrigo Formation (1000 - 1277 feet) Black-colored hornfels with abundant quartz veins, and minor to moderate amounts of iron oxides.		- 1020 -		Medium	
		- -	14.4		
		- 1040 -			
		- -	7.6		
		- 1060 -			
		- -	22.6		
		- 1080 -			
		- -	22.6		
		- 1100 -			
		- -	9		
		- 1120 -			
		- -	17.8		
		- 1140 -			
		- -	14.5		
		- 1160 -			
		- -	15		
		- 1180 -			
		- -	14.1		
		- 1200 -			
		- -	10.7		
		- 1220 -			
		- -	48.1		
		- 1240 -			
		- -	15.7		
		- 1260 -			
		- -	21		
		- 1280 -			
					Total Depth 1277'

# BORING LOG

Page 1 of 3

Project Excelsior		Hole ID NSH-015		Location NSH-CJ	
Project Number 38361		Lithology Described by K. Ford		Date Started 11/11/14	Date Finished 11/15/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 592 feet (11/21/14)	
Drilling Method Air-rotary Hammer				Total Depth 820 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
		- 0 -			Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-580 ft.
SP, <u>Sand with Gravel</u> (20 - 240 feet)		- 20 -			
		- 40 -	1.3		
		- 60 -	0.5		
		- 80 -	0.5		
		- 100 -	0.4	Medium to strong	
		- 120 -	0.4		
		- 140 -	0.5		
		- 160 -	0.4		
		- 180 -	0.5		
		- 200 -	0.4		
		- 220 -	0.5		
		- 240 -	0.5		
SW, <u>Sand with Gravel</u> (240 - 370 feet)		- 260 -	0.5	Weak to medium	
		- 280 -	0.5		
		- 300 -	0.4		

# BORING LOG

Project Excelsior		Hole ID NSH-015			Location NSH-CJ	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Texas Canyon Quartz Monzonite (370 - 800 feet)</u>		- 300 -	0.6			
		- 320 -	0.8			
		- 340 -	1.1			
		- 360 -	1.1			
		- 380 -	1.4			
		- 400 -	1.4			
		- 420 -	1.25			
		- 440 -	1.45			
		- 460 -	1			
		- 480 -	1.4			
		- 500 -	1.5			
		- 520 -	1.1			
		- 540 -	1.05			
		- 560 -	1.35			
		- 580 -	1.1			
		- 600 -	0.75			
		- 620 -	0.85			
		- 640 -	1			
		-				

# BORING LOG

Project Excelsior		Hole ID NSH-015			Location NSH-CJ	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Texas Canyon Quartz Monzonite</u> (370 - 800 feet)		660				
			1.5			
		680				
			1.4			
		700				
			1.1			
		720				
			1.1			
		740				
			1.2			
		760				
			2.15			
		780				
			1.7			
<u>Middle Abrigo Formation</u> (800 - 820 feet) Brown-colored garnetite mixed with white marble.		800			Total depth of boring is 820 feet.	
			1.3	Medium		
		820				



# BORING LOG

Project Excelsior	Hole ID NSH-016		Location NSH-CL		
Project Number 38361	Lithology Described by K. Ford		Date Started 11/15/14	Date Finished 11/19/14	
Drilling Company National EWP	Geophysical Logging Co. COLOG		Site Elevation		
Drilling Equipment GEFCO Speedstar 50K	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 330 feet (11/19/14)		
Drilling Method Air-rotary Hammer			Total Depth 820 feet		
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
	0			Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-580 ft. 8" hammer 580-820 ft.	
SC, <u>Clayey Sand</u> (20 - 30 feet)	20		Medium to strong		
SW, <u>Sand with Gravel</u> (30 - 260 feet)	40	0.35	Strong		
	60	0.5			
	80	0.6			
	100	0.45			
	120	0.5			
	140	0.8			
	160	0.55			
	180	0.65			
	200	0.75			
	220	0.6			
	240	1.1			
	260	0.9			None to weak
	280	1.0			

# BORING LOG

Project Excelsior		Hole ID NSH-016		Location NSH-CL	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
SW, <u>Sand</u> (260-400 feet)	300				
		1.4			
	320				
		1.1			
	340				
		1.25			
	360				
<u>Texas Canyon Formation</u> (400 - 820 feet) Cream-white-pink colored quartz mozonite with secondary potassium feldspar and minor amounts of fluorite.		1.05			
	380				
		0.75			
	400				
		0.85			
	420				
		0.85			
	440				
		0.9			
	460				
		0.95			
	480				
		0.95			
	500				
		1.05			
	520				
		1.15			
	540				
		1.15			
	560				
		1.05			
	580				
		1.4			
	600				
		1.85			
	620				
		1.3			
	640				
		0.9			

## BORING LOG

Project	Excelsior	Hole ID			NSH-016	Location	NSH-CL			
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks					
<u>Texas Canyon Formation</u> (400 - 820 feet) Cream-white-pink colored quartz mozonite with secondary potassium feldspar and minor amounts of fluorite.		- 660 -			Total depth of boring is 820 feet.					
		- -	1.0							
		- 680 -	1.1							
		- 700 -	1.75							
		- 720 -	2.85							
		- 740 -	2.0							
		- 760 -	1.7							
		- 780 -	1.8							
		- 800 -	1.3							
		- 820 -								

# BORING LOG

Project Excelsior		Hole ID NSH-017		Location NSH-CK	
Project Number 38361		Lithology Described by K. Ford		Date Started 11/19/14	Date Finished 12/7/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment GEFCO Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 591 feet (12/14/14)	
Drilling Method Air-rotary Hammer				Total Depth 1200 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SC, <u>Clayey Sand with Gravel</u> (0 - 20 feet)		0		Weak	Dry drilling for BHA 18" hole opener 0-20 ft. 12" hammer 20-930 ft. 11 7/8" tricone 930-1200 ft.
SW, <u>Sand with Gravel</u> (20 - 420 feet)		20			
		40	0.6		
		60			
		80	0.9		
		100	0.6		
		120	0.75		
		140	0.75		
		160	0.75		
		180	0.9		
		200	0.85		
		220	1.15		
		240	1.15		
		260	0.55		
		280	0.9		

# BORING LOG

Project Excelsior	Hole ID NSH-017			Location NSH-CK
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SW, <u>Sand with Gravel</u> (20 - 420 feet)	300			
		0.8		
	320			
		0.9		
	340			
		0.95		
	360			
		0.9		
<u>Texas Canyon Formation</u> (420 - 550 feet) Cream-white colored quartz monzonite.	380			
		0.85		
	400			
		2.2		
	420			
		1.5		
	440			
		1.8		
<u>Middle Abrigo Formation</u> (550 - 630 feet) Dark brown-colored garnetite/garnet-epidote tactite with copper oxides and small dikes of Texas Canyon quartz monzonite.	460			
		2.1		
	480			
		2.4		
	500		Weak	
		2.8		
	520			
		4.1		
<u>Texas Canyon Formation</u> (630 - 720 feet) Cream-white colored quartz monzonite.	540			
		1.7		
	560			
		1.4		
	580			
		1.4		
	600			
		1.4		
	620			
		1.85		
	640			
		2.7		

Project Excelsior	Hole ID NSH-017			Location NSH-CK
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Texas Canyon Formation</u> (630 - 720 feet) Cream-white colored quartz monzonite.	- 660 -			
	- -	3.6		
	- 680 -	2.45		
	- 700 -	5.2		
<u>Middle Abrigo Formation</u> (720 - 740 feet) Dark brown-colored garnetite/garnet-epidote tactite with local magnetite.	- 720 -	2.35		
	- 740 -	3.8		
<u>Texas Canyon Formation</u> (740 - 760 feet) Cream-white colored quartz monzonite containing clasts of Middle Abrigo Formation.	- 760 -	3.9		
	- 780 -	3		
<u>Middle Abrigo Formation</u> (760 - 780 feet) Dark brown-colored garnetite/garnet-epidote tactite with local magnetite.	- 800 -	5.4		
	- 820 -	16.5		
<u>Texas Canyon Formation, Middle Abrigo Formation</u> (780 - 830 feet) Cream-white colored quartz monzonite mixed with brown-colored garnet tactite. Significant dikes of Texas Canyon quartz monzonite cutting the Middle Abrigo Formation.	- 840 -	9.85		
	- 860 -	13.4		
<u>Middle Abrigo Formation</u> (830 - 1030 feet) Dark brown-colored garnet-epidote tactite with dikes of Texas Canyon quartz monzoite and quartz veins.	- 880 -	7.5		
	- 900 -	8.7		
	- 920 -	9.6		
	- 940 -	32		
	- 960 -	29.4		
	- 980 -	11.4		
	- 1000 -	1.7		
	- -			
	- -			
	- -			

# BORING LOG

Page 4 of 4

Project Excelsior		Hole ID NSH-017			Location NSH-CK	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Lower Abrigo Formation</u> (1030 - 1200 feet) Dark-gray to gray-colored hornfels mixed with garnet-epidote tactite.		- 1020 -	1.45		Total depth of boring is 1200 feet.	
		- 1040 -	1.85			
		- 1060 -	1.3			
		- 1080 -	1.75			
		- 1100 -	1.25			
		- 1120 -	6.5			
		- 1140 -	13.2			
		- 1160 -	9			
		- 1180 -	2.7			
		- 1200 -	3.6			

# BORING LOG

Page 1 of 3

Project Excelsior		Hole ID NSH-018		Location NSH-CV	
Project Number 38361		Lithology Described by C. Barnes, D. Huckle		Date Started 11/23/14	Date Finished 12/21/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment Schramm 685		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 591 feet (12/21/14)	
Drilling Method Air-rotary Hammer				Total Depth 1000 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SM, <u>Silty Sand with Gravel</u> (0 - 10 feet)		0	3.4	Weak	Dry drilling for BHA 20" hole opener 0-20 ft. 10" hammer 20-960 ft. 9 7/8" tricone 960-1000 ft.
SM, <u>Silty Sand</u> (10 - 20 feet)		20	1.7		
CL, <u>Lean Clay with Sand</u> (20 – 30 feet)		40	3.0		
SM, <u>Silty Sand</u> (30 - 40 feet)		60	8.5		
GW, <u>Gravel with Sand</u> (40 - 420 feet)		80	0.65		
		100	0.65		
		120	0.8		
		140	0.7		
		160	0.7		
		180	0.75		
		200	0.75		
		220	0.55		
		240	0.9		
		260	0.6		
		280	0.65		
			0.8		



# BORING LOG

Project Excelsior	Hole ID NSH-018			Location NSH-CV
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
GW, <u>Gravel with Sand</u> (40 - 420 feet)	300			
		0.7		
	320			
		0.6		
	340			
		0.85		
	360			
		0.5		
<u>Black Prince Formation</u> (420 – 980 feet) White-colored marble mixed with various tactites and garnet skarns. Minerals observed include copper oxides and iron oxides	380			
		0.25		
	400			
		1.0		
	420			
		1.2		
	440			
		1.4		
	460			
		2.2		
	480			
		2.1		
	500			
		1.45		
	520			
		1.25	Medium to strong	
	540			
		1.3		
	560			
		1.5		
	580			
		1.5		
	600			
	620			
		1.55		
	640			
		1.65		

# BORING LOG

Project Excelsior	Hole ID NSH-018			Location NSH-CV
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Black Prince Formation</u> (420 – 980 feet) White-colored marble mixed with various tactites and garnet skarns. Minerals observed include copper oxides and iron oxides	660			
		2.7		
	680			
		3.45		
	700			
		3.15		
	720			
		3.5		
	740			
		3.45		
	760			
	780			
		2		
	800			
		1.45		
	820			
		1.25		
	840			
		2.6		
	860			
		1.5		
	880			
		1.75		
	900			
		2.7		
	920			
		10.4		
	940			
		27.2		
	960			
		30		
<u>Tertiary Lamprolite?</u> (980 – 990 feet) Black-colored fine-grained rock.	980			
		6.4	None	
<u>Black Prince Formation</u> (990 – 1000 feet) Pale green-colored tactite, likely basal Horquilla.			Medium	
	1000			
				Total depth of boring is 1000 feet.

# BORING LOG

Project Excelsior		Hole ID NSH-019		Location NSH-DA	
Project Number 38361		Lithology Described by K. Mohr		Date Started 12/7/14	Date Finished 12/15/14
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment Speedstar 50K		Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 602 feet (12/17/14)	
Drilling Method Air-rotary Hammer				Total Depth 1410 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SM, <u>Silty Sand with Gravel</u> (0 - 40 feet)		- 0 -		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-640 ft. 7 5/8" hammer 640-1190 ft. 7 1/2" tricone 1190-1410 ft.
		- -			
		- 20 -			
		- -			
		- 40 -			
SP, <u>Sand with Gravel</u> (40 - 550 feet)		- -			
		- 60 -	0.6		
		- -			
		- 80 -	0.45		
		- -			
		- 100 -	0.6		
		- -			
		- 120 -	0.55		
		- -			
		- 140 -	0.45		
		- -			
		- 160 -	0.5		
		- -			
		- 180 -	0.45		
		- -			
		- 200 -	0.6		
		- -			
		- 220 -	0.55		
		- -			
		- 240 -	0.75		
		- -			
		- 260 -	0.8		
		- -			
		- 280 -	0.7		
		- -			

# BORING LOG

Project Excelsior		Hole ID NSH-019			Location NSH-DA	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
SP, <u>Sand with Gravel</u> (40 - 550 feet)		- 300 -	0.6	None		
		- 320 -	0.55			
		- 340 -	1.05			
		- 360 -	0.5			
		- 380 -	0.4			
		- 400 -	0.5			
		- 420 -	0.6			
		- 440 -	0.6			
		- 460 -	0.3			
		- 480 -	0.55			
		- 500 -	0.55			
		- 520 -	0.7			
		- 540 -	1.2			
<u>Martin Formation</u> (550 - 710 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite with copper oxides.		- 560 -	0.95	Strong		
		- 580 -	1.45			
		- 600 -	1.25			
		- 620 -	0.95			
		- 640 -	1.3			
		-	0.75			

Project Excelsior	Hole ID NSH-019			Location NSH-DA
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (550 - 710 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite with copper oxides.	- 660 -			
	- -	0.95		
	- 680 -			
	- -	0.95		
<u>Upper Abrigo Formation</u> (710 - 810 feet) Green-colored actinolite-tremolite tactite with local magnetite tactite and copper oxides.	- 700 -	0.95		
	- 720 -			
	- -	1		
	- 740 -			
	- -	1.15		
	- 760 -		Medium to strong	
	- -	1.05		
<u>Martin Formation</u> (810 - 850 feet) Brown-gray colored dolomite/limestone mixed with magnetite-bearing tactite with copper oxides	- 780 -	1.1		
	- 800 -			
	- -			
	- 820 -		Strong	
	- -	1.15		
<u>Upper Abrigo Formation</u> (850 - 1020 feet) Green-colored actinolite-tremolite tactite with local magnetite tactite and copper oxides.	- 840 -			
	- -	1.15		
	- 860 -			
	- -	1.45		
	- 880 -			
	- -	0.9		
	- 900 -			
	- -	1.05		
	- 920 -			
	- -	1.45	Medium to strong	
	- 940 -			
	- -	2.3		
	- 960 -			
	- -	2.7		
	- 980 -			
	- -	2.8		
	- 1000 -			
	- -	2.6		
	- -			

Project Excelsior	Hole ID NSH-019			Location NSH-DA
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Middle Abrigo Formation (1020 - 1240 feet)</u> Brown-colored garnet-epidote tactite with copper oxides.	- 1020 -	2.1	Medium to strong	
	- 1040 -	2.6		
	- 1060 -	2.7		
	- 1080 -	3.2		
	- 1100 -	4		
	- 1120 -	5.15		
	- 1140 -	8.55		
	- 1160 -	9.25		
	- 1180 -	6.2		
	- 1200 -	13.5		
	- 1220 -	7.55		
	- 1240 -	7.15		
	- 1260 -	8.95		
	- 1280 -	2.3		
	- 1300 -	6.5		
<u>Lower Abrigo Formation (1240 - 1410 feet)</u> Black-gray colored hornfels mixed with garnet-epidote tactite with copper oxides.	- 1320 -	12.3		
	- 1340 -	12.5		
	- 1360 -	11.9		
	-			
	-			

## BORING LOG

Project Excelsior		Hole ID NSH-019		Location NSH-DA	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Lower Abrigo Formation</u> (1240 - 1410 feet)		- 1380 -			Total depth of boring is 1410 feet.
		- -	31.3		
		- 1400 -	42.8		

# BORING LOG

Project Excelsior	Hole ID NSH-020		Location NSH-CX		
Project Number 38361	Lithology Described by J. Cook		Date Started 12/8/14	Date Finished 12/20/14	
Drilling Company National EWP	Geophysical Logging Co. COLOG		Site Elevation		
Drilling Equipment Schramm 685k	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level 603 feet (12/16/2014)		
Drilling Method Air-rotary Hammer			Total Depth 1600 feet		
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithics Alluvium</u> (0 - 300 Feet) 0 to 40 feet is primarily silty sand with approximately 30% fines and 10% gravel. 40 – 300 feet is primarily coarse sand and gravel. Majority of fine material has been washed out of sample from drilling. Approximately 50% of the sample consists of carbonate rocks with the other 50% being granite or similar. Color ranges from white quartz, yellow carbonates, and dark gey to dark brown limestone or dolomite.		0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 10" hammer 20-1135 ft. 9 7/8" tricone 1135-1600 ft.
		20	4.5		
		40	0.6		
		60	0.6		
		80	0.7		
		100	0.6		
		120	0.7		
		140	0.8		
		160	0.8		
		180	0.8		
		200	0.6		
		220	0.7		
		240	0.7		
		260	0.8		
		280	0.7		



Project	Excelsior	Hole ID			NSH-020	Location	NSH-CX	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks			
<u>Granitic Alluvium</u> (300 – 450 feet) Primarily coarse sand and gravel. Fines may have been washed out of sample while drilling. Approximately 80% granite or similar unit and 20% carbonate rocks. Color ranges from tan to with with abundant quartz and minor dark grey to brown carbonate rocks. Some iron oxides present/		300	0.8	Weak				
		320	0.8					
		340	0.9					
		360	1.2					
		380	0.4					
		400	0.4					
		420	0.5					
		440	0.6					
		<u>Black Prince Formation</u> (450 – 1170 feet) Various pale green-white colored tactites mixed with marble/limestone. Copper oxides observed from 1060-1120 feet.				460	1.1	Strong
						480	1.9	
						500	1.4	
						520	1.7	
						540	1.4	
						560	1.8	
580	2.8							
600	2.4							
620	2.4							
640	1.9							

Project Excelsior	Hole ID NSH-020			Location NSH-CX
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Black Prince Formation</u> (450 – 1170 feet) Various pale green-white colored tactites mixed with marble/limestone. Copper oxides observed from 1060-1120 feet.	- 660 -			
	- -	2.3		
	- 680 -			
	- -	2.2		
	- 700 -			
	- -	3.5		
	- 720 -			
	- -	2.6		
	- 740 -			
	- -	1.8		
	- 760 -			
	- -	1.3		
	- 780 -			
	- -	2.9		
	- 800 -			
	- -	2.1		
	- 820 -			
	- -	3.4		
	- 840 -			
	- -	2.2		
	- 860 -			
	- -	3.8		
	- 880 -			
	- -	1.4		
	- 900 -			
	- -	1.2		
	- 920 -			
	- -	1.0		
	- 940 -			
	- -	1.1		
	- 960 -			
	- -	1.6		
	- 980 -			
	- -	1.4		
	- 1000 -			
	- -	1.6		

# BORING LOG

Project Excelsior	Hole ID NSH-020			Location NSH-CX
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Black Prince Formation</u> (450 – 1170 feet)	- 1020 -			
	- -	1.3		
	- 1040 -			
	- -	1.5		
	- 1060 -			
	- -	1.7		
	- 1080 -			
	- -	2.2		
	- 1100 -			
	- -	1.4		
	- 1120 -			
	- -	1.8		
	- 1140 -			
	- -	1.7		
<u>Escabrosa Formation</u> (1170 – 1550 feet) White-colored coarse-grained marble with local brown/black tactites.	- 1160 -			
	- -	1.8		
	- 1180 -			
	- -	1.9		
	- 1200 -			
	- -	1.9		
	- 1220 -			
	- -	2		
	- 1240 -			
	- -	2.5		
	- 1260 -			
	- -	3.0		
	- 1280 -			
	- -	3.2		
	- 1300 -			
	- -	3.3		
	- 1320 -			
	- -	2.6		
	- 1340 -			
	- -	3.2		
	- 1360 -			
	- -	6.2		

## BORING LOG

[illegible]

# BORING LOG

Project Excelsior	Hole ID NSH-021B		Location NSH-DB	
Project Number 38361	Lithology Described by K. Mohr		Date Started 12/15/14	Date Finished 12/18/14
Drilling Company National EWP	Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment Speedstar 50k	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 1260 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
SM, <u>Silty Sand</u> (0 - 70 feet)	0		Strong	
	20	0.35		
	40	1.7		
	60	0.3		
	80	0.45		
SP, <u>Sand with Gravel</u> (70 - 290 feet)	100	0.3		
	120	0.45		
	140	0.6		
	160	0.55		
	180	0.6		
	200	0.65		
	220	0.65		
	240	0.4		
	260	0.6		
	280	0.65		

# BORING LOG

Project Excelsior		Hole ID NSH-021B		Location NSH-DB	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
	300	0.7	Weak		
	320	0.5			
	340	0.65			
	360	0.8			
	380	0.8			
	400	0.75			
	420	0.85			
	440	0.9			
	460	0.95			
	480	1			
	500				
	520				
	540	0.85			
	560	1.35	Strong		
<u>Martin Formation</u> (550 – 650 feet) Dolomite/limestone with green tactite and chrysocolla.	580	1.25			
	600	1.15			
	620	1.33			
	640	1.5			
		1.35			

Project Excelsior	Hole ID NSH-021B			Location NSH-DB
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
Upper Abrigo Formation (650 – 1030 feet) Variably altered calc-silicates with green hornfels and white tactite. Other minerals observed include rhodochrosite, copper oxides, and minor amounts of iron oxide.	660		Weak to strong	
	-	1.3		
	680			
	-	1.15		
	700			
	-	2.9		
	720			
	-	3.3		
	740			
	-	1.25		
	760			
	-	1.5		
	780			
	-	1.6		
	800			
	-	1.25		
	820			
	-	1.3		
	840			
	-	1.25		
	860			
	-	1.3		
	880			
	-	1.05		
	900			
	-	1.15		
	920			
	-	1.15		
	940			
	-	1.15		
	960			
	-	1.5		
	980			
	-	1.45		
	1000			
	-	1.6		

# BORING LOG

Project Excelsior		Hole ID NSH-021B			Location NSH-DB	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Middle Abrigo Formation</u> (1030 – 1260 feet) Predominately consists of dark brown-colored garnetite with copper oxides and iron oxides.		- 1020 -				
		- -	1.25			
		- 1040 -				
		- -	1.5			
		- 1060 -				
		- -	1.1			
		- 1080 -				
		- -	1			
		- 1100 -				
		- -	1.2			
		- 1120 -				
		- -	9.25			
		- 1140 -				
		- -	15.5			
		- 1160 -				
		- -	19			
		- 1180 -				
		- -	16.4			
		- 1200 -				
		- -	15.1			
		- 1220 -				
		- -	16.8			
		- 1240 -				
		- -				
		- 1260 -				



# BORING LOG

Project Excelsior	Hole ID NSH-021C	Location NSH-DB		
Project Number 38361	Lithology Described by K, Ford	Date Started 1/9/15	Date Finished 1/13/15	
Drilling Company National EWP	Geophysical Logging Co. COLOG	Site Elevation		
Drilling Equipment Speedstar 50k	Geophysical Logs Acoustic Televiwer Caliper Natural Gamma	Water Level		
Drilling Method Air-rotary Hammer		Total Depth 1400 feet		
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-50 feet) Well graded sand with silt (SW-SM). Consists of approximately 15% gravel, 10% fines, and 75% sand. Sand and gravel are white and light to dark grey; fines are medium brown. Gravels consist of quartz monzonite; light green tactite; orange-brown limestone; grey limestone; yellow/orange/grey dolomite. Sand consists of quartz, plagioclase, magnetite, limestone, dolomite, and tactite. Angular to sub-rounded. 80% granitic, 20% lithic.	0		Mod - Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-620 ft. 7 7/8" hammer 620-1160 ft. 7 7/8" tricone 1160-1400 ft.
	20			
	40	0.30		
	60	0.55		
<u>Mixed Lithic Alluvium</u> (50-290 feet) Poorly graded sand with gravel (SP). Consists of approximately 25% gravel, <5% fines, and 70% sand. Fines are white and light to dark grey; pale orange-brown. Gravels consist of mixed lithics including quartz monzonite; limestone; dolomite; garnetite; magnetite; hornfels; and tactite. Angular to sub-rounded. 60% granitic, 40% lithic.	80	0.60	Mod - Strong	Fines washed out during drilling.
	100	0.50		
	120	0.50		
	140	0.55		
	160	0.60		
	180	0.60		
	200	0.80		
	220	1.00		
	240	0.60		
	260	0.70		
	280	0.65		

Project Excelsior	Hole ID NSH-021C			Location NSH-DB
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium (290 - 540 feet)</u> Poorly graded sand with gravel (SP). Approximately 15% gravel, <5% fines, 80% sand. Greater than 90% granitic with the remaining 10% lithics. Granitic material predominantly white light grey, pale yellow/orange. Lithics consist of quartz monzonite, plagioclase, minor tactite, limestone, dolomite, magnetite, and hornfels. Sub angular to rounded. Subangular to subrounded. Max gravel size is approximately 25 mm.	300	0.80	Weak	
	320	0.75		
	340	1.00		
	360	0.65		
	380	0.85		
	400	0.85		
	420	0.65		
	440	0.75		
	460	0.95		
	480	0.65		
	500	0.55		
	520	0.70		
	540	0.90		
	560	1.00		
	580	1.10		
<u>Martin Formation (540-620 feet)</u> Variably altered carbonates. Colors include reddish/purple brown, light green, and white. Highly mineralized zones Chrysocolla between 590 and 620 feet.	600	0.90	Weak	Installed 8 inch casing from 0 to 620 ft bgs.
	620	0.80		
	640	1.10		
<u>Martin Formation/Upper Abrigo Transition (620-640 feet)</u>				Possible gradational contact. Started drilling with 7 7/8" hammer.

Project Excelsior	Hole ID NSH-021C			Location NSH-DB
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation</u> (640-1020 feet) Sandy dolomite. Color ranges from light green to greenish grey. Highly mineralized zones of Chrysocolla between 640-670 feet and 750-830 feet.	- 660 -		Weak	
	- -	1.25		
	- 680 -			
	- -	1.35		
	- 700 -			
	- -	1.35		
	- 720 -			
	- -	1.85		
	- 740 -			
	- -	0.90		
	- 760 -			
	- -	1.80		
	- 780 -			
	- -	1.15		
	- 800 -			
	- -	1.85		
	- 820 -			
	- -	1.20		
	- 840 -			
	- -	1.65		
	- 860 -			
	- -	1.75		
	- 880 -			
	- -	1.25		
	- 900 -			
	- -	1.65		
	- 920 -			
	- -	1.25		
	- 940 -			
	- -	1.80		
	- 960 -			
	- -	1.20		
	- 980 -			
	- -	1.75		
	- 1000 -			
	- -	2.10		

Project Excelsior	Hole ID NSH-021C			Location NSH-DB
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Middle Abrigo Formation (1020-1250 feet)</u> Brown garnetite with zones of variable alteration to black lithics. Copper mineralization is variable with zones observed between 1070-1080 feet and 1140-1150 feet. Minor white marble.	- 1020 -		Weak	
	- -	2.85		
	- 1040 -			
	- -	1.80		
	- 1060 -			
	- -	1.75		
	- 1080 -			
	- -	1.10		
	- 1100 -			
	- -	2.30		
	- 1120 -			
	- -	8.30		
	- 1140 -			
	- -	6.80		
	- 1160 -			
<u>Lower Abrigo Formation (1250-1370 feet)</u> Dark green altered calc-silicates. Minor white carbonates.	- -	3.25		
	- 1180 -			
	- -	1.60		
	- 1200 -			
	- -	1.55		
	- 1220 -			
	- -	0.90		
	- 1240 -			
	- -	1.30		
	- 1260 -			
	- -	0.90		
	- 1280 -			
	- -	0.80		
	- 1300 -			
	- -	1.52		
	- 1320 -			
	- -	3.36		
	- 1340 -			
	- -	4.65		
	- 1360 -			
	- -	2.54		

## BORING LOG

[illegible]

# BORING LOG

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Project Excelsior	Hole ID NSH-022		Location NSH-BF	
Project Number 38361	Lithology Described by C. Price, J. Cook		Date Started 12/20/14	Date Finished 1/19/14
Drilling Company National EWP	Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment Schramm 685	Geophysical Logs Acoustic Televiwer Caliper, Electrical Resistivity, Natural Gamma, Sonic		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 1170 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-320 feet) Primarily sand with gravel (GW). Approximately 50% granitic and 50% other lithics (limestone & dolomite). Sub angular to sub rounded.	0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 12" hammer 20-645 ft. 11 5/8" tricone 645-1700 ft.
	20			
	40	1.10		
	60	0.70		
	80	0.90		
	100	0.65		
	120	0.30		
	140	0.45		
	160	0.40		
	180	0.30		
	200	0.25		
	220	0.25		
	240	0.40		
	260	0.80		
	280	0.85		

Project Excelsior	Hole ID NSH-022			Location NSH-BF
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-320 feet)	300	.55		
<u>Granitic Alluvium</u> (320 - 600 feet) Primarily sand with gravel (GW). Greater than 90% granitic with the remaining 10% made up of carbonates. Tan to off-white. Subangular to subrounded.	320	0.55	Weak	
	340	0.50		
	360	0.50		
	380	0.60		
	400	0.75		
	420	0.65		
	440	0.55		
	460	0.50		
	480	0.55		
	500	0.55		
	520	1.85		
	540	1.00		
	560	1.60		
	580	1.45		
	600	2.45	Medium to strong	
	620	4.85		
	640			
<u>Escabrosa Formation</u> (600-720 feet) Primarily a coarse grained granular marble. White in color with zones of iron oxide and dark reddish banding. Subangular to subrounded				

# BORING LOG

Project	Excelsior	Hole ID			NSH-022	Location	NSH-BF
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks		
<u>Escabrosa Formation</u> (600-720 feet)		- 660 -	17.8				
		- -	6.7				
		- 680 -					
		- -	8.65				
		- 700 -					
<u>Martin Formation</u> (720-1000 feet) Variably altered carbonates. Abundant iron oxides throughout. Color ranges from white, brown, and dark grey. Highly mineralized zones Chrysocolla between 730-770 feet and 930-960 feet.		- -	12.4				
		- 720 -					
		- -	10.5				
		- 740 -					
		- -	15.5				
		- 760 -					
		- -	17.9				
		- 780 -					
		- -	13.3				
		- 800 -					
		- -	18.4				
		- 820 -					
		- -	32.0				
		- 840 -					
		- -	14.6				
		- 860 -					
		- -	14.5				
		- 880 -					
		- -	7.5				
		- 900 -					
- -	12.0						
- 920 -							
- -	13.6						
- 940 -							
- -	10.0						
- 960 -							
- -	16.0						
- 980 -							
- -	2.1						
		- 1000 -					
		- -	3.55				



# BORING LOG

Project Excelsior		Hole ID NSH-022			Location NSH-BF	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Abrigo Formation</u> (1000-1170 feet) Variably altered carbonates. Color ranges from dark grey to dark grey. Zones of light colored carbonates throughout. Abundant micaceous minerals in upper section.		- 1020 -		Weak	Total depth of boring is 1170 feet.	
		- -	8.75			
		- 1040 -				
		- -	8.85			
		- 1060 -				
		- -	7.4			
		- 1080 -				
		- -	48.1			
		- 1100 -				
		- -	25.3			
		- 1120 -				
		- -	29.9			
		- 1140 -				
		- -	19.5			
		- 1160 -				
		- -	12.5			
		- 1170 -				
		- -				
		- -				
		- -				
		- -				
		- -				
		- -				
		- -				

# BORING LOG

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Project Excelsior		Hole ID NSH-023		Location NSH-DD	
Project Number 38361		Lithology Described by J, Cook		Date Started 1/14/15	Date Finished 1/17/15
Drilling Company National EWP		Geophysical Logging Co. COLOG		Site Elevation	
Drilling Equipment Speedstar 50k		Geophysical Logs Electrical Resistivity, Acoustic Televiewer, Sonic, Neutron, Caliper, Gamma, Density		Water Level	
Drilling Method Air-rotary Hammer				Total Depth 1440 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-420 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to light brown. Lithics are comprised of carbonates and are mostly green to brown in color.		- 0 -		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-645 ft. 7 7/8" hammer 645-1440 ft.
		- 20 -			
		- 40 -	0.50		
		- 60 -	0.45		
		- 80 -	0.35		
		- 100 -	0.40		
		- 120 -	0.55		
		- 140 -	0.55		
		- 160 -	0.55		
		- 180 -	0.55		
		- 200 -	0.55		
		- 220 -	0.60		
		- 240 -	0.70		
		- 260 -	0.55		
		- 280 -	0.60		
		- - -			

# BORING LOG

Project Excelsior	Hole ID NSH-023			Location NSH-DD
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium (0-420 feet)</u> Approximately 50% granitic and 50% lithics. Granitics are tan to light brown. Lithics are comprised of carbonates and are mostly green to brown in color.	300	0.55	Strong	
	320	0.50		
	340	0.65		
	360	0.50		
	380	0.55		
	400	0.60		
	420	0.60		
	440	0.70		
	460	0.70		
	480	0.55		
<u>Granitic Alluvium (420 - 620 feet)</u> Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to light brown; bitotite is common. Lithics consist of carbonates.	500	0.55	Weak	
	520	0.60		
	540	0.75		
	560	0.55		
	580	0.60		
	600	0.60		
	620	1.15		
	640	0.75		
<u>Martin Formation (620-850 feet)</u>				

Project Excelsior	Hole ID NSH-023			Location NSH-DD
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (620-850 feet) Variably altered carbonates. Colors include brown to light grey. Copper oxide observed from 590-620 feet; 720-740 feet; at 780 feet; and 820-840 feet.	- 660 -		Strong	
	- 680 -	0.70		
	- 700 -	1.10		
	- 720 -	1.50		
	- 740 -	1.10		
	- 760 -	1.20		
	- 780 -	1.30		
	- 800 -	1.35		
	- 820 -	1.40		
	- 840 -	1.65		
	- 860 -	1.95		
	- 880 -	1.05		
	- 900 -	1.30		
	- 920 -	1.15		
<u>Upper Abrigo Formation</u> (850-1190 feet) Dark to light green tactite. Abundant iron oxides present. Minor amounts of copper oxides observed. Siclikeous zone between 1150 and 1160.	- 940 -	1.70		
	- 960 -	1.55		
	- 980 -	1.35		
	- 1000 -	2.35		
	- 1020 -	2.15		
	- 1040 -			
	- 1060 -			

Project Excelsior	Hole ID NSH-023			Location NSH-DD
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation (850-1190 feet)</u> Dark to light green tactite. Abundant iron oxides present. Minor amounts of copper oxides observed. Siclikeous zone between 1150 and 1160.	- 1020 -			
	- -	2.10		
	- 1040 -			
	- -	1.45		
	- 1060 -			
	- -	2.15		
	- 1080 -			
	- -	1.75		
	- 1100 -			
	- -	2.20		
	- 1120 -			
	- -	3.10		
<u>Middle Abrigo Formation (1190-1260 feet)</u> Brown garnetite with zones of variable alteration to black lithics which include pyrite and sulfides. Gold an blueish purple sulfides between 1230 and 1240 feet.	- 1140 -			
	- -	2.25		
	- 1160 -			
	- -	2.60		
<u>Lower Abrigo Formation (1260-1440 feet)</u> Dark green altered calc-silicates. Dark green hornfels, sulfides, pyrite, and chalcopryite. Lower part rich in black hornfels.	- 1180 -			
	- -	2.60		
	- 1200 -			
	- -	3.20		
	- 1220 -			
	- -	1.85		
	- 1240 -			
	- -	2.00		
	- 1260 -			
	- -	2.95		
	- 1280 -			
	- -	2.15		
	- 1300 -			
	- -	1.65		
	- 1320 -			
	- -	2.25		
	- 1340 -			
	- -	2.55		
	- 1360 -			
	- -	3.25		

## BORING LOG

[illegible]

Project Excelsior		Hole ID NSH-024		Location NSH-DC	
Project Number 38361		Lithology Described by J, Cook		Date Started 1/18/15	Date Finished 1/22/15
Drilling Company National EWP		Geophysical Logging Co. IDS		Site Elevation	
Drilling Equipment Speedstar 50k		Geophysical Logs Electrical Resistivity, Acoustic Televiwer, Sonic, Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer				Total Depth 1440 feet	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-380 feet) Well graded sand with silt (SW-SM). Consists of approximately 15% gravel, 10% fines, and 75% sand. Sand and gravel are white and light to dark grey; fines are medium brown. Gravels consist of quartz monzonite; light green tactite; orange-brown limestone; grey limestone; yellow/orange/grey dolomite. Sand consists of quartz, plagioclase, magnetite, limestone, dolomite, and tactite. Angular to sub-rounded. 50% granitic, 50% lithic.		0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-625 ft. 7 7/8" hammer 625-1440 ft.
		20			
		40	0.50		
		60	0.55		
		80	0.35		
		100	0.50		
		120	0.55		
		140	0.60		
		160	0.55		
		180	0.50		
		200	0.50		
		220	0.45		
		240	0.55		
		260	0.60		
		280	0.60		

Project Excelsior	Hole ID NSH-024			Location NSH-DC
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-380 feet)	300	0.50		
	320	0.50		
	340	0.65		
	360	0.55		
	380	0.60		
	400	0.50		
<u>Granitic Alluvium</u> (380 - 600 feet) Poorly graded sand with gravel (SP). Approximately 15% gravel, <5% fines, 80% sand. Greater than 90% granitic with the remaining 10% lithics. Granitic material predominantly white light grey, pale yellow/orange. Lithics consist of quartz monzonite, plagioclase, minor tactite, limestone, dolomite, magnetite, and hornfels. Sub angular to rounded. Subangular to subrounded. Max gravel size is approximately 25 mm.	420	0.60	Weak	
	440	0.55		
	460	0.55		
	480	0.60		
	500	0.60		
	520	0.55		
	540	0.60		
	560	0.60		
	580	0.60		
	600	0.65		
	620	1.55		
	640	1.85		
<u>Martin Formation</u> (600-800 feet) Variably altered carbonates. Color is predominantly light green and brown. Highly mineralized zones between 640-660 feet; 690-720; 770-800.				



# BORING LOG

Project Excelsior	Hole ID NSH-024			Location NSH-DC
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (600-800 feet)	- 660 -			
	- -	1.80		
	- 680 -			
	- -	1.30		
	- 700 -			
	- -	1.40		
	- 720 -			
	- -	0.90		
	- 740 -			
	- -	1.35		
<u>Upper Abrigo Formation</u> (800-1100 feet) Green tactite with variable zones of iron oxide. Color ranges from light green to greenish grey. Highly mineralized zones of Chrysocolla between 850-860 feet; 890-900; and 1020-1030 feet. Pink magnesium oxide at 1010-1040.	- 760 -			
	- -	1.10		
	- 780 -			
	- -	1.10		
	- 800 -			
	- -	1.30		
	- 820 -			
	- -	1.55		
	- 840 -			
	- -			
	- 860 -			
	- -	0.90		
	- 880 -			
	- -	2.40		
	- 900 -			
	- -	2.95		
	- 920 -			
	- -	1.65		
	- 940 -			
	- -	1.90		
	- 960 -			
	- -	1.90		
	- 980 -			
	- -	1.70		
	- 1000 -			
	- -	1.85		

Project Excelsior	Hole ID NSH-024			Location NSH-DC
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation</u> (800-1100 feet)	- 1020 -			
	- -	2.55		
	- 1040 -			
	- -	1.95		
	- 1060 -			
	- -	2.95		
<u>Middle Abrigo Formation</u> (1100-1270 feet) Largely a brown garnetite oxide zone. Siliceous interval from 1200-1250 feet. Copper oxide mineralization observed at 1160; 1220-1240; and 1260 feet.	- 1080 -			
	- -	2.10		
	- 1100 -			
	- -	2.35		
	- 1120 -			
	- -	1.5		
	- 1140 -			
	- -	2.75		
	- 1160 -			
	- -	2.10		
	- 1180 -			
	- -	2.75		
<u>Lower Abrigo Formation</u> (1270-1445 feet) Dark green to black hornfels, sulfide mineralization (pyrite and chalcopryrite) throughout. Siliceous zone from 1350-1390.	- 1200 -			
	- -	2.95		
	- 1220 -			
	- -	3.10		
	- 1240 -			
	- -	1.15		
	- 1260 -			
	- -	1.65		
	- 1280 -			
	- -	1.60		
	- 1300 -			
	- -	2.60		
	- 1320 -			
	- -	3.35		
	- 1340 -			
	- -	6.00		
	- 1360 -			
	- -	3.00		

## BORING LOG

[illegible]

# BORING LOG

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Project Excelsior	Hole ID NSH-025		Location NSH-DP	
Project Number 38361	Lithology Described by J, Cook		Date Started 1/19/15	Date Finished 1/26/15
Drilling Company National EWP	Geophysical Logging Co. IDS		Site Elevation	
Drilling Equipment Schramm 685	Geophysical Logs Electrical Resistivity, Acoustic Televiwer, Sonic, Caliper Natural Gamma		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 1596 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-310 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and mostly green to brown in color.	0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 10" hammer 20-1596 ft.
	20	0.50		
	40	0.35		
	60	0.75		
	80	1.00		
	100	0.70		
	120	0.90		
	140	0.85		
	160	0.80		
	180	0.85		
	200	0.50		
	220	0.55		
	240	0.75		
	260	0.70		
	280	1.05		

Project Excelsior	Hole ID NSH-025			Location NSH-DP
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium</u> (310 - 600 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to light brown; bitotite is common. Lithics consist of carbonates.	- 300 -	0.50		
	- 320 -	0.45		
	- 340 -	0.65		
	- 360 -	0.90		
	- 380 -	0.55		
	- 400 -	0.35		
	- 420 -	0.65		
	- 440 -	0.55		
	- 460 -	0.40		
	- 480 -	0.75		
	- 500 -	0.70		
	- 520 -	0.85		
	- 540 -	0.85		
	- 560 -	0.95		
	- 580 -	0.50		
	- 600 -	0.90		
	- 620 -	0.70		
	- 640 -	1.10		
	-			
<u>Martin Formation</u> (600-830 feet) Variably altered carbonates. Color is predominantly light green and brown. Locally, zones of white marble were encountered. Copper oxide is present throughout; notably between 780 and 830 feet.	-			

Project Excelsior	Hole ID NSH-025			Location NSH-DP
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (600-830 feet)	- 660 -			
	- -	1.05		
	- 680 -			
	- -	0.85		
	- 700 -			
	- -	0.70		
	- 720 -			
	- -	1.15		
	- 740 -			
	- -	1.45		
	- 760 -			
	- -	1.70		
<u>Upper Abrigo Formation</u> (830-1150 feet) Green tactite with variable zones of iron oxide. Color ranges from light green to greenish grey. Variable amounts of amounts of iron oxides. Minor copper oxides (which are less concentrated than the overlying Martin). Silica poor throughout with one notable exception between 1120 and 1130 feet.	- 780 -			
	- -	1.25		
	- 800 -			
	- -	1.75		
	- 820 -			
	- -	2.05		
	- 840 -			
	- -	2.81		
	- 860 -			
	- -	1.50		
	- 880 -			
	- -	1.75		
	- 900 -			
	- -	2.20		
	- 920 -			
	- -	2.35		
	- 940 -			
	- -	2.45		
	- 960 -			
	- -	2.70		
	- 980 -			
	- -	2.25		
	- 1000 -			
	- -	0.85		

# BORING LOG

Project Excelsior	Hole ID NSH-025			Location NSH-DP
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation</u> (830-1150 feet)	- 1020 -			
	- -	1.85		
	- 1040 -			
	- -	1.30		
	- 1060 -			
	- -	1.65		
	- 1080 -			
	- -	1.60		
	- 1100 -			
	- -	1.50		
<u>Middle Abrigo Formation</u> (1150-1230 feet) Largely a brown garnetite oxide zone. Color ranges include brown, red, green, and orange. Minor copper oxide mineralization observed.	- 1120 -			
	- -	1.95		
	- 1140 -			
	- -	2.35		
	- 1160 -			
	- -	1.40		
<u>Lower Abrigo Formation</u> (1230-1590 feet) Dark grey to green tactite. Upper section between 1230 and 1290 is largely oxide rich. The remaining unit between 1290 and 1590 consists mainly of sulfide mineralization. Pyrite is common. A small granitic zone was encountered between 1420 and 1460. Oxide rich material was observed between 1560 and 1590.	- 1180 -			
	- -	1.55		
	- 1200 -			
	- -	1.90		
	- 1220 -			
	- -	2.00		
	- 1240 -			
	- -	1.00		
	- 1260 -			
	- -	2.25		
	- 1280 -			
	- -	1.50		
	- 1300 -			
	- -	1.50		
	- 1320 -			
	- -	1.75		
	- 1340 -			
	- -	2.10		
	- 1360 -			
	- -	2.40		

# BORING LOG

Project Excelsior	Hole ID NSH-025			Location NSH-DP
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Lower Abrigo Formation</u> (1230-1590 feet)	- 1380 -			
	- -	2.40		
	- 1400 -			
	- -	3.05		
	- 1420 -			
	- -	2.35		
	- 1440 -			
	- -	2.00		
	- 1460 -			
	- -	2.35		
	- 1480 -			
	- -	2.20		
	- 1500 -			
	- -	1.85		
	- 1520 -			
	- -	2.85		
	- 1540 -			
	- -	2.95		
	- 1560 -			
	- -	4.00		
	- 1580 -			
	- -	5.90		
<u>Bolsa Quartzite</u> (1590-1596 feet) Light colored quartzite (white to tan). Sulfide rich with pyrite, chalcopyrite. Minor molybdenite and copper oxide.	- 1600 -			Total depth of boring is 1596 feet.
	- -			
	- 1620 -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			
	- -			



# BORING LOG

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Project Excelsior	Hole ID NSH-026		Location NSH-BE		
Project Number 38361	Lithology Described by J. Cook		Date Started 1/23/15	Date Finished 1/26/15	
Drilling Company National EWP	Geophysical Logging Co. IDS		Site Elevation		
Drilling Equipment Speedstar 50k	Geophysical Logs Electrical Resistivity, Acoustic Televiwer, Caliper, Neutron Natural Gamma, Density, Sonic		Water Level		
Drilling Method Air-rotary Hammer			Total Depth 905 feet		
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-310 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and mostly dark green to brown in color.		0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-620 ft. 7 7/8" hammer 620-905 ft.
		20			
		40			
		60	0.45		
		80	0.45		
		100	0.60		
		120	0.55		
		140	0.35		
		160	0.70		
		180	0.70		
		200	0.60		
		220	0.85		
		240	0.75		
		260	0.70		
		280	0.60		
			0.70		

# BORING LOG

Project Excelsior	Hole ID NSH-026			Location NSH-BE
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium</u> (310 - 600 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to white. Lithics consist of carbonates and are tan to white in color.	- 300 -	0.70	Strong	
	- 320 -	0.60		
	- 340 -	0.75		
	- 360 -	0.95		
	- 380 -	0.85		
	- 400 -	1.35		
	- 420 -	0.60		
	- 440 -	1.00		
	- 460 -	1.00		
	- 480 -	1.15		
	- 500 -	1.00		
	- 520 -	0.85		
	- 540 -	0.75		
	- 560 -	0.65		
	- 580 -	0.80		
	- 600 -	1.30		
	- 620 -	1.50		
	- 640 -	1.10		
	-			
	-			
<u>Escabrosa Limestone</u> (600-700 feet) Mostly white granular marble. Locally, dark banding present. Grey limestone and iron oxide present between 680 and 700 feet.	-		Strong	

# BORING LOG

Project Excelsior		Hole ID NSH-026			Location NSH-BE	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
		660				
			1.20			
		680				
			0.90			
		700				
<u>Upper Abrigo Formation (700-905 feet)</u> Altered carbonates. Dark brown to green oxide rich carbonates. Locally, there are lighter tan and brown bands of granular carbonate. Copper oxide is present between 730-740 and 810-830 feet. Red-brown iron oxides present near 900 feet.			1.15	Strong		
		720				
			1.20			
		740				
			1.30			
		760				
			1.80			
		780				
			2.15			
		800				
			1.55			
		820				
			1.55			
		840				
			1.20			
		860				
			1.60			
		880				
			1.60			
		900			Total depth of boring is 905 feet.	
		920				
		940				
		960				
		980				
		1000				

# BORING LOG

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Project Excelsior	Hole ID NSH-027		Location NSH-BG	
Project Number 38361	Lithology Described by J, Cook		Date Started 1/26/15	Date Finished 2/1/15
Drilling Company National EWP	Geophysical Logging Co. IDS		Site Elevation	
Drilling Equipment Schramm 685	Geophysical Logs Electrical Resistivity, Acoustic Televiwer, Caliper Natural Gamma, Sonic		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 1022 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-310 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and mostly dark green, brown, and orange in color.	0	2.20	Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 12 3/8" hammer 20-1025 ft.
	20	0.75		
	40	0.75		
	60	1.50		
	80	0.40		
	100	0.40		
	120	0.40		
	140	0.45		
	160	0.35		
	180	0.50		
	200	0.50		
	220	0.40		
	240	0.65		
	260	0.55		
	280	0.50		

# BORING LOG

Project Excelsior	Hole ID NSH-027			Location NSH-BG
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
	- 300 -	1.05		
<u>Granitic Alluvium</u> (310 - 490 feet) Greater than 90% granitic with the remaining 10% comprised of lithics. Granitic material predominantly tan to white. Lithics consist of carbonates and are tan to white in color.	- 320 -	0.65	Weak	
	- 340 -	0.65		
	- 360 -	0.65		
	- 380 -	0.55		
	- 400 -	0.75		
	- 420 -	0.50		
	- 440 -	0.75		
	- 460 -	0.50		
	- 480 -	0.75		
	- 500 -	1.25		
<u>Martin Formation</u> (490-810 feet) Primarily brown to dark brown altered carbonates. Minor copper oxides between 780 and 790 feet.	- 520 -	1.00	Strong	
	- 540 -	1.45		
	- 560 -	1.50		
	- 580 -	1.35		
	- 600 -	1.25		
	- 620 -	1.45		
	- 640 -	1.10		
	- 660 -			

Project Excelsior	Hole ID NSH-027			Location NSH-BG
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (490-810 feet)	- 660 -	1.60		
	- 680 -	1.00		
	- 700 -	1.15		
	- 720 -	1.10		
	- 740 -	1.25		
	- 760 -	1.50		
	- 780 -	1.05		
	- 800 -	1.50		
<u>Upper Abrigo Formation</u> (810-1022 feet) Altered carbonates. Primarily pale green to dark green. Increased copper oxidizes between 920 and 1000 feet. Large zone of iron oxide from 950 to 990 feet.	- 820 -	1.35	Strong	
	- 840 -	0.75		
	- 860 -	1.20		
	- 880 -	1.30		
	- 900 -	1.95		
	- 920 -	2.50		
	- 940 -	2.90		
	- 960 -	3.30		
	- 980 -	3.00		
	- 1000 -	1.85		

# BORING LOG

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Project Excelsior		Hole ID NSH-027			Location NSH-BG
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
	- 1020 -	4.14		Total depth of boring is 1022 feet.	
	- -				
	- 1040 -				
	- -				
	- 1060 -				
	- -				
	- 1080 -				
	- -				
	- 1100 -				
	- -				
	- 1120 -				
	- -				
	- 1140 -				
	- -				
	- 1160 -				
	- -				
	- 1180 -				
	- -				
	- 1200 -				
	- -				
	- 1220 -				
	- -				
	- 1240 -				
	- -				
	- 1260 -				
	- -				
	- 1280 -				
	- -				
	- 1300 -				
	- -				
	- 1320 -				
	- -				
	- 1340 -				
	- -				
	- 1360 -				
	- -				

# BORING LOG

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Project Excelsior	Hole ID NSH-028		Location NSH-BH	
Project Number 38361	Lithology Described by J, Cook		Date Started 1/27/15	Date Finished 1/29/15
Drilling Company National EWP	Geophysical Logging Co. IDS		Site Elevation	
Drilling Equipment Speedstar 50k	Geophysical Logs Electrical Resistance, Acoustic Televiwer, Caliper, Natural Gamma, Neutron, Density		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 800 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-300 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and color ranges from dark brown to reddish brown.	0		Strong	Dry drilling for BHA 20" hole opener 0-20 ft. 13" hammer 20-540 ft. 7 7/8" hammer 540-800 ft.
	20			
	40	0.40		
	60	0.90		
	80	0.40		
	100	0.40		
	120	0.40		
	140	0.45		
	160	0.50		
	180	0.50		
	200	0.50		
	220	0.50		
	240	0.45		
	260	0.50		
	280	0.55		



# BORING LOG

Project Excelsior	Hole ID NSH-028			Location NSH-BH
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium</u> (300 - 500 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to white and consist of quartz and feldspar. Lithics are comprised of carbonates and biotite.	300	0.45	Weak	
	320	0.55		
	340	0.80		
	360	0.70		
	380	0.75		
	400	0.90		
	420	0.75		
	440	0.80		
	460	0.70		
	480	0.75		
	500	1.50		
	520	1.70		
	540	1.30	Weak	
	560	1.15		
<u>Martin Formation</u> (530-790 feet) Dark colored altered carbonates. Zones of flaky tan dolomite. Copper oxides are found throughout. Iron oxides present between 760 and 780 feet.	580	0.60		
	600	1.20		
	620	1.15		
	640	1.05		
<u>No Sample</u> (500-530 feet)				495'-535'-Lost circulation

# BORING LOG

Project Excelsior		Hole ID NSH-028			Location NSH-BH	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Martin Formation</u> (530-790 feet)		660				
			0.85			
		680				
			1.10			
		700				
			1.70			
		720				
			1.15			
		740				
			1.15			
		760				
			1.15			
		780				
			1.80			
<u>Upper Abrigo Formation</u> (790-800 feet) Altered carbonates. Light to dark green tactite. Minor copper and iron oxides.		800		None	Total depth of boring is 800 feet.	
		820				
		840				
		860				
		880				
		900				
		920				
		940				
		960				
		980				
		1000				

# BORING LOG

Page 1 of 3

Project Excelsior	Hole ID NSH-029		Location NSH-DR	
Project Number 38361	Lithology Described by M. Rex		Date Started 1/28/15	Date Finished 1/29/15
Drilling Company BJ Drilling	Geophysical Logging Co.		Site Elevation	
Drilling Equipment	Geophysical Logs		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 710 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-290 feet) Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and color ranges from dark brown to reddish brown. Angular to subangular.	0		None	Dry drilling for BHA 11" hole opener 0-20 ft. 6 1/2" hammer 20-710 ft.
		1.00		
	20	0.50		
		0.55		
	60	0.75		
		0.75		
	80	0.75		
		0.60		
	100	0.60		
		0.55		
	120	0.55		
		0.55		
	140	0.55		
		0.70		
	160	0.70		
		0.55		
	180	0.55		
		0.75		
	200	0.75		
		0.80		
	220	0.80		
		1.10		
	240	1.10		
		0.75		
	260	0.75		
		0.75		
	280	0.75		
		0.75		

# BORING LOG

Project Excelsior		Hole ID NSH-029			Location NSH-DR	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Granitic Alluvium</u> (290 - 500 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to white and consist of quartz and feldspar. Lithics are comprised of carbonates. Mostly angular.		- 300 -	0.70	None		
		- 320 -	0.80			
		- 340 -	0.70			
		- 360 -	0.85			
		- 380 -	0.75			
		- 400 -	0.65			
		- 420 -	0.60			
		- 440 -	0.65			
		- 460 -	0.70			
		- 480 -	0.70			
		- 500 -	1.05			
		- 520 -	1.30			
		- 540 -	1.15			
		- 560 -	1.50			
<u>Martin Formation</u> (500-710 feet) Altered carbonates. Intervals of marble, garnetite, and skarn. Colors include creamy white, tan, and brown. Copper oxides between 630 and 660 feet.		- 580 -	1.60	Weak		
		- 600 -	1.55			
		- 620 -	1.25			
		- 640 -	1.30			
		-				
		-				

# BORING LOG

Project Excelsior	Hole ID NSH-029			Location NSH-DR
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Martin Formation</u> (500-710 feet) Altered carbonates. Intervals of marble, garnetite, and skarn. Colors include creamy white, tan, and brown. Copper oxides between 630 and 660 feet.	- 660 -			Total depth of boring is 710 feet.
	- -	1.45		
	- 680 -			
	- -	1.75		
	- 700 -	1.50		
	- 720 -			
	- -			
	- 740 -			
	- -			
	- 760 -			
	- -			
	- 780 -			
	- -			
	- 800 -			
	- -			
	- 820 -			
	- -			
	- 840 -			
	- -			
	- 860 -			
	- -			
	- 880 -			
	- -			
	- 900 -			
	- -			
	- 920 -			
	- -			
	- 940 -			
	- -			
	- 960 -			
	- -			
	- 980 -			
	- -			
	- 1000 -			
	- -			

# BORING LOG

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Project Excelsior	Hole ID NSH-030		Location NSH-DQ	
Project Number 38361	Lithology Described by M, Rex		Date Started 1/29/15	Date Finished 2/3/15
Drilling Company BJ Drilling	Geophysical Logging Co.		Site Elevation	
Drilling Equipment	Geophysical Logs		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 740 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-330 feet) Fine grained sandy gravel with clay. Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and color ranges from dark brown to reddish brown. Angular to subangular.	0		Slight	Dry drilling for BHA 11" hole opener 0-20 ft. 6 1/2" hammer 20-740 ft.
		0.25		
	20			
		0.40		
	40			
		0.45		
	60			
		0.45		
	80			
		0.45		
	100			
		0.50		
	120			
		0.55		
	140			
		0.50		
	160			
		0.50		
	180			
		0.55		
	200			
		0.60		
	220			
		0.75		
	240			
		0.65		
	260			
		0.60		
	280			
		0.60		

Project Excelsior	Hole ID NSH-030			Location NSH-DQ
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-330 feet)	300			
		0.50		
	320	1.30		
<u>Horquilla Formation</u> (330 - 420 feet) Fine grained limestone/marble. Sub angular. Creamy white in color. Garnetite bed between 370 and 400 feet.	340		Strong	
		3.30		
	360	2.40		
	380	1.60		
	400	1.30		
	420			
<u>Black Prince Limestone</u> (420 - 560 feet) Fine to medium grained limestone. Green, grey, brown, and black in color. Angular to sub angular. Trace amounts of chrysocolla at 480 feet.		1.70	Strong	
	440			
	460	1.25		
	480	1.55		
	500	1.25		
	520	1.90		
	540	1.75		
	560			
<u>Escabrosa Limestone</u> (560 - 740 feet) Fine grained limestone/marble. Creamy white in color. Angular to subangular.		1.40	Strong	
	580	0.75		
	600	3.50		
	620	1.50		
	640			
		1.20		

# BORING LOG

Project Excelsior		Hole ID NSH-030			Location NSH-DQ	
Description		Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks	
<u>Escabrosa Limestone</u> (560 - 740 feet)		- 660 -			Total depth of boring is 740 feet.	
		-	1.10			
		- 680 -				
		-	2.05			
		- 700 -				
		-	1.45			
		- 720 -				
		-	1.35			
		- 740 -				
		-				
		- 760 -				
		-				
		- 780 -				
		-				
		- 800 -				
		-				
		- 820 -				
		-				
		- 840 -				
		-				
		- 860 -				
		-				
		- 880 -				
		-				
		- 900 -				
		-				
		- 920 -				
		-				
		- 940 -				
		-				
		- 960 -				
		-				
		- 980 -				
		-				
		- 1000 -				
		-				



# BORING LOG

Page 1 of 3

Project Excelsior	Hole ID NSH-031		Location NSH-DS	
Project Number 38361	Lithology Described by M, Rex		Date Started 1/30/15	Date Finished 2/3/15
Drilling Company BJ Drilling	Geophysical Logging Co.		Site Elevation	
Drilling Equipment	Geophysical Logs		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 820 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-320 feet) Fine grained sandy gravel with clay. Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and color ranges from dark brown to reddish brown. Angular to subangular.	0		None- Slight	Dry drilling for BHA 11" hole opener 0-20 ft. 6 1/2" hammer 20-820 ft.
		1.00		
	20	0.20		
	40	0.20		
	60	0.50		
	80	0.40		
	100	0.30		
	120	0.35		
	140	0.30		
	160	0.30		
	180	0.35		
	200	0.35		
	220	0.35		
	240	0.35		
	260	0.30		
	280	0.35		

# BORING LOG

Project Excelsior	Hole ID NSH-031			Location NSH-DS
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium</u> (320 - 420 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to white and consist of quartz and feldspar. Lithics are comprised of carbonates. Angular to sub angular.	300	0.40	None	
	320	0.30		
	340	0.35		
	360	0.30		
	380	0.55		
	400	0.65		
	420	0.90		
	440	0.90		
<u>Martin Formation</u> (420 - 620 feet) Fine to medium grained marble and garnetite. Cream to light brown in color. Angular to sub angular.	460	0.90	Mod-Strong	
	480	0.85		
	500	1.00		
	520	0.95		
	540	1.10		
	560	0.90		
	580	1.05		
	600	0.85		
	620	0.75		
	640	0.90		
<u>Fault Zone?</u> (620 - 640 feet) Fine sand with high amounts of iron staining.				
<u>Upper Abrigo Formation</u> (620 - 820 feet)				

# BORING LOG

Project Excelsior	Hole ID NSH-031			Location NSH-DS
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Upper Abrigo Formation</u> (620 - 820 feet) Altered carbonates. Fine grained fragments. Green, tan, and brown in color. Angular to sub angular. Trace chrysocolla.	- 660 -		Strong	740 – 760 feet; Possible fault zone.
	- 680 -	0.90		
	- 700 -	1.85		
	- 720 -	1.25		
	- 740 -	1.40		
	- 760 -	1.40		
	- 780 -	1.45		
	- 800 -	1.20		
	- 820 -	1.40		
	- 840 -			
	- 860 -			
	- 880 -			
	- 900 -			Total depth of boring is 820 feet.
	- 920 -			
	- 940 -			
	- 960 -			
	- 980 -			
	- 1000 -			
	-			
	-			
	-			
	-			
	-			
	-			

# BORING LOG

Page 1 of 3

Project Excelsior	Hole ID NSH-032		Location NSH-DT	
Project Number 38361	Lithology Described by M, Rex		Date Started 2/6/15	Date Finished 2/8/15
Drilling Company BJ Drilling	Geophysical Logging Co.		Site Elevation	
Drilling Equipment	Geophysical Logs		Water Level	
Drilling Method Air-rotary Hammer			Total Depth 820 feet	
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Mixed Lithic Alluvium</u> (0-320 feet) Fine grained sandy gravel with clay. Approximately 50% granitic and 50% lithics. Granitics are tan to white with abundant quartz. Lithics are comprised of carbonates and color ranges from dark brown to reddish brown. Angular to subangular.	0		None-Slight	Dry drilling for BHA 11" hole opener 0-20 ft. 6 1/2" hammer 20-820 ft.
		1.00		
	20	0.50		
	40	0.25		
	60	0.80		
	80	0.65		
	100	0.50		
	120	0.35		
	140	0.40		
	160	0.35		
	180	0.40		
	200	0.40		
	220	0.40		
	240	0.35		
	260	0.35		
	280	0.35		

# BORING LOG

Project Excelsior	Hole ID NSH-032			Location NSH-DT
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Granitic Alluvium</u> (320 - 420 feet) Greater than 90% granitic with the remaining comprised of 10% lithics. Granitic material predominantly tan to white and consist of quartz and feldspar. Lithics are comprised of carbonates. Angular to sub angular.	300	0.40	None	
	320	0.40		
	340	0.45		
	360	0.50		
	380	0.35		
	400	0.50		
	420	0.50		
	440	0.60	Mod-Strong	
<u>Martin Formation</u> (420 - 620 feet) Fine to medium grained marble and garnetite. Cream to light brown in color. Angular to sub angular.	460	0.90		
	480	0.70		
	500	0.90		
	520	0.80		
	540	0.80		
	560	0.85		
	580	0.75		
	600	0.90		
	620	0.85		
	640	0.80		
<u>Fault Zone?</u> (620 - 640 feet) Fine sand with high amounts of iron staining.				

# BORING LOG

Project Excelsior	Hole ID NSH-032			Location NSH-DT
Description	Depth (ft)	Drill Rate (min/ft)	Reaction to HCl	Remarks
<u>Abrigo Formation</u> (620 - 820 feet) Altered carbonates. Fine grained fragments. Green, tan, and brown in color. Angular to sub angular. Trace chrysocolla.	- 660 -		Strong	
	- 680 -	1.05		
	- 700 -	1.05		
	- 720 -	1.45		
	- 740 -	2.40		
	- 760 -	1.85		
	- 780 -	1.55		
	- 800 -	1.60		
	- 820 -	1.80		
	- 840 -			
	- 860 -			
	- 880 -			
	- 900 -			Total depth of boring is 820 feet.
	- 920 -			
	- 940 -			
	- 960 -			
	- 980 -			
	- 1000 -			
	-			
	-			
	-			
	-			
	-			
	-			

## **APPENDIX B**

### **Well Completion Field Forms**

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-203</u>		Staff: <u>J. Cook, B. Kienberger</u>	
Well ID: <u>NSH-007</u>		Dates: <u>10-21-14 to 10-22-14</u>			
Total Well/Casing Depth: <u>469'</u>		Length of Rathole: <u>15</u> feet		Rat Hole Volume: <u>11.7</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>8.625</u> inches		Rat Hole Volume per foot: <u>0.78</u> Ft <sup>3</sup> /Lin. Ft			
Borehole Diameter [D]: <u>8.625</u> inches		Borehole Diameter [D]: <u>0.78</u> inches		Annular Volume per Linear Foot: (interval)	
12 inches		484 - 469		Ft <sup>3</sup> /Ft	
12 inches		469 - 20		Ft <sup>3</sup> /Ft	
				Ft <sup>3</sup> /Ft	
				Ft <sup>3</sup> /Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	~12.00	~12	469	469	280	1/4" x 1/8" TACNA.
1	✓	2.8	14.8	461.6	463	440	4 sks of bentonite chips
1	✓	1.1	15.8	460.4	-	440	No 20 x 10 40 sand 2x 50 lb bags.
1	✓	1.2	17.0	457.2	-	440	5 gallon Buckets of 1/4" x 208 TACNA. x2
1	✓	50.1	67.1	325.4	-	440	49 bags of cement, 1 bag bentonite, ~200 gal WATER
2	✓	32.9	100	238.8	-	440	44 bags of cement, 1 bag bentonite, ~170 gal WATER
3	✓	31.9	131.9	154.9	-	440	39 bags of cement, 1 bag bentonite, ~200 gal WATER
4	✓	36.0	167.9	54.6	~230	340	44 bags of cement, 1 bag bentonite, ~170 gal
5	✓	27.9	195.8	-13.3	-	340	34 bags of cement, 1 bag bentonite, ~150 gal
6	✓	31.4	227.7	-97.2	-	340	39 bags of cement, 1 bag bentonite, ~200 gal
7	✓	31.9	259.6	-181.1	~60	340	39 bags of cement, 1 bag bentonite, ~200 gal

Notes:	Annular volume cubic feet per linear foot = (D <sup>2</sup> - d <sup>2</sup> ) x 0.005454
	ALL DEPTHS ARE FEET BELOW LAND SURFACE
	50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>
	Density of sand and gravel = 100 lbs/Ft <sup>3</sup>
	Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>
	Total Bags of Cement: <u>486</u>
	Total Bags of Bentonite Gel: <u>10</u>
	Total Bags of Bentonite Chips: <u>6</u>
	Total Bags of Transition Sand: <u>4</u>
	Total Super Sacks of Filter Pack: <u>~ 1200/2000 LBS.</u>



Page 2 of 2

Staff: J. COOK, B. KIENENBÖCKER

Dates: 10-21-14 to 10-22-14

Notes:

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## PIPE TALLY 8" CASING

Project Name: EXCELSIOR	Project No.: 38681-203
Well No.: NSH-007 <del>NSH-62</del>	Date: 10-18-14 - 10-19-14, 10-21-14
Location: NSH-CP	Pipe Tally for: INTERMEDIATE CASING
Total Depth: 469'	Geologist: DAVE ANDERSEN

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ OtherJason Cook  
10-21-14

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.00		Int. Casing	1	✓	19.99		INT Casing
2	✓	20.03	40.03	Cut Off To remove from well.	2	✓	20.04	40.03	
3	✓	20.03	60.06		3	✓	19.99	60.02	
4	✓	20.05	80.11		4	✓	20.07	80.09	
5	✓	20.0	100.11		5	✓	19.99	100.08	
6	✓	20.0	120.11		6	✓	20.07	120.15	
7	✓	20.01	140.12		7	✓	20.07	140.22	
8	✓	19.99	160.11		8	✓	20.00	160.22	
9	✓	20.0	180.11		9	✓	19.98	180.20	
10	✓	20.0	200.11		10	✓	20.05	200.25	
11	✓	20.02	220.13		11	✓	20.07	220.32	
12	✓	20.02	240.15		12	✓	19.98	240.30	
13	✓	20.02	260.17		13	✓	20.01	260.31	
14	✓	20.02	280.19		14	✓	20.04	280.35	
15	✓	20.02	300.21		15	✓	20.00	300.35	
16	✓	20.02	320.22		16	✓	20.13	320.48	
17	✓	20.01	340.23		17	✓	20.12	340.6	
18	✓	20.04	360.27		18	✓	20.12	360.72	
19	✓	20.00	380.27		19	✓	20.15	380.87	
20	✓	20.01	400.28		20	✓	20.14	401.01	
21		20.04	420.32		21	✓	20.15	421.16	
22		20.03	440.35		22	✓	20.12	441.28	
23		20.04	460.39		23	✓	20.15	461.43	
24		20.00	480.39		SUMMARY OF TALLY 10-21-14				
Cut Off				Total Length tallied: 481.56'					
				Casing Stick-Up: 12.56'					
				Length of Casing Cut-Off: 11.56'					
				Bottom of Well: CASING 469'					
				Screened Interval: STICKUP 1.0					
24	✓	20.13	481.56	Total Screen in Hole: —					

Notes:

Installation order does not match Pipe Number. Some was counted in laydown area. Some was delivered later due to well depth differences all complete joints except for last 1/2 joint. last joint will be cut off at correct length

Need length of cut off piece. Subtract from total

#20 had a section cut off when removed on 10-19-2014

#12 was cut off and re welded.

All pipe on the left was cut out. lengths changed- will be used on a different well.

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-204</u>		Staff: <u>Jason Cook, Dan Anderson, Brandon</u>	
Well ID: <u>NB H-008</u>		Dates: <u>10-28-14, 11/20/14</u>			
Total Well/Casing Depth: <u>840</u> feet		Length of Rathole: <u>7</u> feet		Rat Hole Volume: <u>3.8</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>41.5</u> inches		Rat Hole Volume per foot: <u>.55</u> Ft <sup>3</sup> /in. Ft			
Borehole Diameter [D]: <u>10</u> inches		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>12</u> inches		<u>433-445</u>		<u>Ft<sup>3</sup>/Ft</u>	
<u>16</u> inches		<u>390-386</u>		<u>Ft<sup>3</sup>/Ft</u>	
<u>12.25</u> inches		<u>0-20</u>		<u>Ft<sup>3</sup>/Ft</u>	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	~2000	20	-	804		804	1/4" x 1/2" x 8" Trench
2	3000	30	50	740	741.7	740	1/4" x 1/2" x 8" Trench
3	3000	30	80	670	673	720	1/4" x 1/2" x 8" Trench
	~1900	~19	61	717	717	-	Removal of trench via air lift.
1	360	3.6	64.6	710.5	710.5	700	6 x Buckets of 1/4" x 1/2" x 8" Trench. (5 gallon)
1	300	3	67.6	703.5	703.3	700	6 x 50lb Bags of 1/2" x 1/2" x 1/2" Transition Sand
2	200	2	64.6	648.7	649.9	700	4 x 50lb Bags of 1/2" x 1/2" x 1/2" Transition Sand
1		24	43.6	645	-	640	6 x 50lb bag of Bentonite gel + 150 gallons of water
2		23.5	117.1	590	-	580	5 x 50lb bag of Bentonite gel + 150 gallons of water
3		23.5	140.6	535	-	520	"
4		23.5	164.1	480	-	460	"

Notes: Annular volume cubic feet per linear foot = ( D <sup>2</sup> - d <sup>2</sup> ) x 0.005454	
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>	
Density of sand and gravel = 100 lbs/Ft <sup>3</sup>	
Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>	

Total Bags of Cement:	
Total Bags of Bentonite Gel:	101
Total Bags of Bentonite Chips:	68 (11-20-14)
Total Bags of Transition Sand:	9
Total Super Sacks of Filter Pack:	3 and ~1/2, Includes removed trench

1 1/3 SKS ON 11-20-14

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-204</u>		Staff: <u>Jason Cook, Dane Anderson, Brandon K</u>				
Well ID: <u>NSH008</u>		Dates: <u>10-28-2014</u> , <u>11/20/14</u>						
Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
5	✓		23.5	187.6	437	-	460	5x50lb bags of bentonite + 150 gallons of water
6	✓		23.5	211.1	393	-	400	"
7	✓		23.5	234.6	338	-	340	"
8	✓		23.5	258.1	283	-	340	"
9	✓		23.5	281.6	228	-	300	"
10	✓		23.5	305.1	173	-	300	"
11	✓		23.5	328.6	118	-	300	"
12	✓		23.5	352.1	63	-	300	"
13	✓		23.5	375.6	8	-	300	"
14	✓		23.5	399.1	+47	-	300	"
15	✓		23.5	422.6	+102	-	300	"
16	✓		23.5	446.1	+157	-	280	"
17	✓		23.5	469.6	+212	-	280	"
18	✓		23.5	493.1	+267	-	280	"
19	✓		23.5	516.6	+322	-	280	"
20	✓		23.5	540.1	+377	0	280	"
					~191		-	GRout SETTLED ~191 FEET (11-20-14)
1			47.6	587.7	80	-	-	3/8-INCH BENTONITE CHIPS (68 SKS)
2		4000	40.0	627.7	0	0	-	1/4-INCH No. 8 TACNA (1 1/3 SKS)

Notes: About 44ft too much Filter pack was installed. Filter pack was Air lifted out of borehole to a tagged depth of 717'. The total volume of Tarna Remove is estimated to be ~19 cuft.

## PIPE TALLY 4" CASING

Project Name.: <i>Excelsior</i>	Project No.: <i>38681-204</i>
Well No.: <i>NSH-008</i>	Date: <i>10-28-2011</i>
Location: <i>NSH-CR</i>	Pipe Tally for: <i>Screen and casing</i>
Total Depth: <i>900 + fill</i>	Geologist: <i>Jason Cook</i>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.06	—	4" slotted screen	31	✓	20.05	622.51	4" casing
2	✓	20.07	40.13		32	✓	20.09	642.60	
3	✓	20.11	60.24		33	✓	20.06	662.66	
4	✓	20.08	80.30		34	✓	20.03	682.69	
5	✓	20.12	100.42		35	✓	20.07	702.76	
6	✓	20.13	120.55	↓	36	✓	20.06	722.82	
7	✓	20.07	140.62	4" casing	37	✓	20.08	742.90	
8	✓	20.08	160.70		38	✓	20.06	762.96	
9	✓	20.08	180.78		39	✓	20.09	783.05	
10	✓	20.07	200.85		40	✓	20.07	803.12	
11	✓	20.07	220.92		41	✓	20.10	823.22	
12	✓	20.10	241.02		42	✓	20.09	843.31	↓
13	✓	20.09	261.07						
14	✓	20.08	281.15						
15	✓	20.08	301.23						
16	✓	20.07	321.30						
17	✓	20.07	341.37						
18	✓	20.08	361.45						
19	✓	20.08	381.53						
20	✓	20.10	401.63						
21	✓	20.08	421.71						
22	✓	20.09	441.80						
23	✓	20.09	461.89						
24	✓	20.08	481.95						
25	✓	20.08	502.03						
26	✓	20.09	522.12						
27	✓	20.10	542.22						
28	✓	20.09	562.31						
29	✓	20.09	582.40						
30	✓	20.08	602.46						

## SUMMARY OF TALLY

Total Length tallied:	843.3
Casing Stick-Up:	3.0
Length of Casing Cut-Off:	3.0
Bottom of Well:	840
Screened Interval:	720-840
Total Screen in Hole:	120

Notes:



# ANNULAR MATERIAL RECORD

Project: Excavator Staff: C. Price, D. Anderson  
 Well ID: NSA-009 Project No.: 38681-204 Dates: 11-4-14 to 11-19-14, 11-23-14

Total Well/Casing Depth: 995 feet Length of Rathole: 13 feet Rat Hole Volume: 12.0 Ft³  
 Well/Casing Diameter [d]: 4.5 inches Rat Hole Volume per foot: 0.92 Ft³/Lin. Ft

Borehole Diameter [D]: 10 inches Annular Volume per Linear Foot: (interval) Borehole Diameter [D]: inches Annular Volume per Linear Foot: (interval) Ft³/Ft  
10 inches 0.43 Ft³/Ft  
10 inches 0.92 Ft³/Ft Rathole  
 inches Ft³/Ft  
 inches Ft³/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	30	30	953	941	940	1/4" inch x No. 8 TACNA Filter Pack
2	✓ 3000	30	60	871	875	860	
3	✓ 2400	24	84	819	825	820	
3	500	5	89	813	824	820	↓ COMPLETION 11-5-14
					820		ANNULAR MATERIALS REMOVED TO 820 FT
4	✓ 1200	12	101	792	795	780	ON 11-7-14 DUE TO BAD SEAL, 11-7-2
1	✓ 650	6.5	107.5	779	785	780	1/4" inch x No. 8 TACNA, 18 x 5 gal buckets
1	✓ -	238	131.3	730	-	740	NO. 20 x 40 TRANSITION SAND (13 BAGS)
2	✓ -	24.4	155.7	674	-	680	BENTONITE GROUT, 4 x 50 lb BAGS + ~170 GAL WATER
3	✓ -	24.4	180.1	617	-	620	↓, 6 x " ↓ ~170 GAL WATER

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$   
 ALL DEPTHS ARE FEET BELOW LAND SURFACE  
 50 lbs bag of bentonite chips = 0.7 Ft³  
 Density of sand and gravel = 100 lbs/Ft³  
 Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement: -  
 Total Bags of Bentonite Gel: 70 + 18  
 Total Bags of Bentonite Chips: 15  
 Total Bags of Transition Sand: 13  
 Total Super Sacks of Filter Pack: ~3.5 + 3.75

# ANNULAR MATERIAL RECORD

Project: Excelsior  
Well ID: NSH-009

Project No.: 38681-204  
Dates: 11-4-14 to 11-19-14, 11-23-14

Staff: C. Puccio, D. Anderson

Super Sk. or Batch	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
4	-	24.4	24.5	560	-	560	BENTONITE GROUT, 60x50lb BAGS + ~170 GALLON WATER
5	-	24.4	228.9	503	-	500	
6	-	24.4	253.3	446	-	440	
7	-	24.4	277.7	389	-	380	
8	-	24.4	302.1	332	-	320	
9	-	24.4	326.5	275	-	260	
10	-	24.4	350.9	218	-	200	
11	-	24.4	375.3	161	-	140	
12	-	24.4	399.7	104	-	80	
13	-	24.4	424.1	47	0	20	11-8-14
					~590		11-20-14 GROUT DROPPED TO ~590 FT
1	-	48.6	472.7	546	-	-	BENTONITE GROUT, 7x50lb BAGS + ~350 GALLON WATER
2	-	41.4	514.1	450	-	-	↓ 5 ↓ + ~300 GALLON WATER
3	-	41.7	555.8	353	-	-	↓ 6 ↓
1	-	2.1	557.9	348	-	-	BENTONITE CHIPS (3 BAGS)
2	-	4.9	562.8	337	-	-	↓ (7 BAGS) (11-23-14)
1	3000	30.0	592.8	267	-	-	44-INCH x NO. 8 TACNA GRAVEL PACK
2	3000	30.0	622.8	197	-	-	
3	3000	30.0	652.8	127	-	-	
4	2250	22.5	675.3	57	6	-	↓
	-	3.5	678.8	1	0	-	BENTONITE CHIPS (5 BAGS)

Notes:

## PIPE TALLY 4" SCREEN

Project Name.: <u>EXCELSIOR</u>	Project No.: <u>38081-204</u>
Well No.: <u>NSA-009</u>	Date: <u>11-4-14</u>
Location: <u>NSH-CS</u>	Pipe Tally for: <u>Screen + casing</u>
Total Depth: <u>995'</u>	Geologist: <u>D. Andersen, C. Price</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.58	20.58	SCREEN	31	✓	20.13	624.18	CASING
2	✓	20.14	40.72		32	✓	20.14	644.32	
3	✓	20.22	60.94		33	✓	20.12	664.44	
4	✓	20.17	81.11		34	✓	20.16	684.60	
5	✓	20.16	101.27		35	✓	20.12	704.72	
6	✓	20.20	121.47		36	✓	20.12	724.84	
7	✓	20.10	141.57		37	✓	20.13	744.97	
8	✓	20.06	161.63		38	✓	20.16	765.13	
9	✓	20.08	181.71		39	✓	20.12	785.25	
10	✓	20.12	201.83		40	✓	20.08	805.33	
11	✓	20.12	221.95	CASING	41	✓	20.06	825.39	
12	✓	20.13	242.08		42	✓	20.16	845.55	
13	✓	20.14	262.22		43	✓	20.08	865.63	
14	✓	20.14	282.36		44	✓	20.03	885.66	
15	✓	20.06	302.42		45	✓	20.09	905.75	
16	✓	20.15	322.57		46	✓	20.07	925.82	
17	✓	20.06	342.63		47	✓	20.01	945.84	
18	✓	20.06	362.69		48	✓	20.07	965.91	
19	✓	20.13	382.82		49	✓	20.08	986.04	
20	✓	20.07	402.89		50	✓	20.12	1006.16	
21	✓	20.06	422.95	51	✓	20.10	1026.26	OUT	
22	✓	20.18	443.13						
23	✓	20.06	463.19						
24	✓	20.14	483.33						
25	✓	20.04	503.40						
26	✓	20.13	523.53						
27	✓	20.14	543.67						
28	✓	20.14	563.81						
29	✓	20.10	583.91						
30	✓	20.14	604.05						
					SUMMARY OF TALLY				
					Total Length tallied:	1006.2'			
					Casing Stick-Up:	11.0'			
					Length of Casing Cut-Off:	11.0'			
					Bottom of Well:	995'			
					Screened Interval:	813-995'			
					Total Screen in Hole:	181.7'			

Notes:

4.5" O.D., 4" I.D. ASTM A53B ASME SRL  
\* CENTRALIZER INSTALLED



# ANNULAR MATERIAL RECORD

Project: Excelsior
Well ID: N5H-010

Project No.: 38681-203
Staff: Chad Price, Dane Andersen, C. Gardner

Dates: 11-1-14 - 11-2-14

Total Well/Casing Depth: 546 feet
Well/Casing Diameter [d]: 8 5/8 inches

Length of Rathole:      feet
Rat Hole Volume per foot:      Ft³/Lin. Ft

Rat Hole Volume:      Ft³

Borehole Diameter [D]: 13.25 inches
Annular Volume per Linear Foot: (interval) 546 - 00

Borehole Diameter [D]:      inches
Annular Volume per Linear Foot: (interval)      Ft³/Ft

Borehole Diameter [D]:      inches
Annular Volume per Linear Foot: (interval)      Ft³/Ft

Borehole Diameter [D]:      inches
Annular Volume per Linear Foot: (interval)      Ft³/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	23.5	28.5	494	486	—	48 Bags - 47 lb bag cement + water + CaCl
2	✓	23.3	51.8	451.6	—	—	160 gal water + 6-50 lb bag Bentonite
3	✓	23.3	75.1	409.2	—	434	Same
4	✓	23.3	98.4	366.8	—	434	Same
5	✓	23.3	121.7	324.4	—	354	Same
6	✓	23.3	145	282	—	354	Same
7	✓	23.3	168.3	239.6	—	294	Same
8	✓	23.3	191.6	197.2	—	294	Same
9	✓	23.3	214.9	154.8	—	194	Same
10	✓	23.3	238.2	112.4	—	139	Same
11	✓	23.3	261.5	70	—	139	Same

Notes: Annular volume cubic feet per linear foot = (D² - d²) x 0.005454

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft³

Density of sand and gravel = 100 lbs/Ft³

Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement: 48

Total Bags of Bentonite Gel: —

Total Bags of Bentonite Chips: 66

Total Bags of Transition Sand: —

Total Super Sacks of Filter Pack: —

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Staff: C. Price, D. Andersen, C. Gardner

Dates: 11-1-14

[illegible]

Notes: 160 gal water + 6-50 lb bags Bentonite = 23.3 ft<sup>3</sup> → 42.4 ft<sup>3</sup>/lin ft

## PIPE TALLY 8" CASING

Project Name.: EXCELSIOR	Project No.: 38681
Well No.: NSH-010	Date: 11/1/14
Location: NSH-CT	Pipe Tally for: 8 5/8" CASING
Total Depth: 546 FT BS	Geologist: C. PRICE, C. GARNON

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	X	20.13	20.13	8" BLANK					
2	X	20.10	40.23						
3	X	20.11	60.34						
4	X	20.11	80.45						
5	X	20.11	100.56						
6	X	20.11	120.67						
7	X	20.11	140.78						
8	X	20.11	160.89						
9	X	20.11	181.00						
10	X	20.12	201.12						
11	X	20.11	221.23						
12	X	20.12	241.35						
13	X	20.12	261.47						
14	X	20.11	281.58						
15	X	20.10	301.68						
16	X	20.13	321.81						
17	X	20.12	341.93						
18	X	20.12	362.05						
19	X	20.12	382.17						
20	X	20.13	402.30						
21	X	20.12	422.42						
22	X	20.12	442.54						
23	X	20.13	462.67						
24	X	20.11	482.78						
25	X	20.12	502.90						
26	X	20.13	523.03						
27	X	20.11	543.14						
28	X	20.11	563.25	↓					
					SUMMARY OF TALLY				
					Total Length tallied: 563.25'				
					Casing Stick-Up: 0				
					Length of Casing Cut-Off: 11.93'				
					Bottom of Well: 546'				
					Screened Interval: -				
					Total Screen in Hole: -				

Notes:

~~20 rods~~  
 28 Joints 8 5/8" OD LCS 0.25" wall thickness,  
 beveled ends, ASTM A53  
 8 3/16" ID

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-202</u>		Staff: <u>C. Price, Kyle Mohr</u>	
Well ID: <u>N5H-012</u>		Dates: <u>11-10-14</u> , <u>11-20-14</u>			
Total Well/Casing Depth: <u>490</u> feet		Length of Rathole: <u>14</u> feet		Rat Hole Volume: <u>10.9</u> Ft³	
Well/Casing Diameter [d]: <u>4.5</u> inches		Rat Hole Volume per foot: <u>0.78</u> Ft³/Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>11.5</u> inches	<u>0.61</u> Ft³/Ft	<u>14</u> inches	<u>0.95</u> Ft³/Ft	<u>42-20</u>	
<u>12</u> inches	<u>0.67</u> Ft³/Ft	<u>      </u> inches	<u>      </u> Ft³/Ft	<u>      </u>	
<u>12.5</u> inches	<u>0.74</u> Ft³/Ft	<u>      </u> inches	<u>      </u> Ft³/Ft	<u>      </u>	
<u>13</u> inches	<u>0.81</u> Ft³/Ft	<u>      </u> inches	<u>      </u> Ft³/Ft	<u>      </u>	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	30	30	458.7	456.5	460	1/4" x NO. 8 Tacoma
2	✓ 3000	30	60	419.5	421.5	395	1/4" x NO. 8 Tacoma. Used only ~ 3/4 of sk.
1	✓ 500	5	65	441.7	446.3	395	No. 20 x 40 transition sand 10 x 50 16 bags
2	✓ 250	2.3	67.3	413.0	413.3	395	No. 20 x 40 transition sand 6 x 50 16 bags
3	✓ 300	3	70.3	409.8	409.0	375	No. 20 x 40 transition sand 6 x 50 16 bags
1	✓	23.5	93.8	386.79	-	-	150 gal of water + 5 bags of barite 66L
2	✓	23.5	117.3	349.83	-	-	"
3	✓	23.5	140.8	320.02	-	-	"
4	✓	23.5	164.3	288.26	-	-	"
5	✓	23.5	187.8	256.50	-	-	"
6	✓	23.5	211.3	224.74	-	-	"

Notes: Annular volume cubic feet per linear foot = ( D² - d² ) x 0.005454	
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft³	
Density of sand and gravel = 100 lbs/Ft³	
Full super sack (sk.) of filter pack is 30 Ft³	
Total Bags of Cement: <u>      </u>	
Total Bags of Bentonite Gel: <u>67 + 23 = 90</u>	
Total Bags of Bentonite Chips: <u>3</u>	
Total Bags of Transition Sand: <u>21</u>	
Total Super Sacks of Filter Pack: <u>2</u>	

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Staff: C. PZKO, K. Mohr

Dates: 11-10-14, 11-20-14

Notes:

# PIPE TALLY 4 1/2" CASING

Project Name.: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-012</u>	Date: <u>11-10-14</u>
Location: <u>NSH-CU</u>	Pipe Tally for: <u>4 1/2" casing</u>
Total Depth: <u>502' 490'</u>	Geologist: <u>C. Price</u>

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.09	20.09	screen w/ bull nose plug and centralizer at bottom					
2	✓	20.16	40.25	screen					
3	✓	20.02	60.27	screen w/ centralizer ~10' from top of screen					
4	✓	20.09	80.36	casing					
5	✓	20.02	100.38	casing					
6	✓	20.05	120.43	casing					
7	✓	20.01	140.44						
8	✓	20.07	160.51						
9	✓	20.08	180.59						
10	✓	20.04	200.63						
11	✓	20.02	220.65						
12	✓	20.06	240.71						
13	✓	20.08	260.79						
14	✓	20.08	280.87						
15	✓	20.05	300.92						
16	✓	20.22	321.14						
17	✓	20.06	341.20						
18	✓	20.10	361.30						
19	✓	20.10	381.40						
20	✓	20.15	401.55						
21	✓	20.09	421.64						
22	✓	20.08	441.72						
23	✓	20.16	461.88						
24	✓	20.16	482.04						
25	✓	20.12	502.16						
					SUMMARY OF TALLY				
					Total Length tallied:				
					Casing Stick-Up:				
					Length of Casing Cut-Off:				
					Bottom of Well:				
					Screened Interval:				
					Total Screen in Hole:				

Notes:

4.5" OD ASTM A53B LCS  
4" ID  
22 casing  
3 screen  
Will need 11.89' of casing set above land surface. ✓  
23 tremie rods 20'  
1 beveled 19' tremie rod

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-</u>		Staff: <u>C. Pave</u>	
Well ID: <u>N3H-013</u>		Dates: <u>11-8-14</u> <u>12-13-14</u>			
Total Well/Casing Depth: <u>646</u> feet		Length of Rathole: <u>—</u> feet		Rat Hole Volume: <u>—</u> Ft³	
Well/Casing Diameter [d]: <u>8.625</u> inches		Rat Hole Volume per foot: <u>—</u> Ft³/Lin. Ft			
Borehole Diameter [D]: <u>13.5</u> inches		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>13.5</u> inches		<u>0.52</u> Ft³/Ft		<u>646</u> - <u>20</u>	
<u>13.5</u> inches		<u>0.59</u> Ft³/Ft		<u>20</u> - <u>0</u>	
<u>—</u> inches		<u>—</u> Ft³/Ft		<u>—</u>	
<u>—</u> inches		<u>—</u> Ft³/Ft		<u>—</u>	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	25.4	25.4	597.2	—	600	26 bags cement, 1 bag quick gel
1	✓	23.8	49.2	552.2	—	560	6 bags Bentonite gel
2	✓	23.8	73.0	526.4	—	520	Same
3	✓	23.8	96.8	460.6	—	440	Same
4	✓	23.8	120.6	414.8	—	440	Same
5	✓	23.8	144.4	371.5	—	360	Same
6	✓	23.8	168.2	328.7	—	360	Same
7	✓	23.8	192	282.9	—	280	Same
8	✓	23.8	215.8	237.1	—	280	Same
9	✓	23.8	239.6	191.3	—	280	Same
10	✓	23.8	263.4	145.5	—	180	Same

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft³

Density of sand and gravel = 100 lbs/Ft³

Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement:	36
Total Bags of Bentonite Gel:	78
Total Bags of Bentonite Chips:	60
Total Bags of Transition Sand:	—
Total Super Sacks of Filter Pack:	1.25

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**Notes:**



# PIPE TALLY 8" CASING

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-013</u>	Date: <u>11-5-14</u>
Location: <u>NSH-BW</u>	Pipe Tally for: <u>intermediate casing</u>
Total Depth: <u>650' 646'</u>	Geologist: <u>C. Price &amp; Jason Cook</u>

8 3/8

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.12	—	TNT casing	31	✓	20.12	623.73	int casing
2	✓	20.13	40.25		32	✓	20.13	643.86	
3	✓	20.11	60.36		33	✓	20.12	663.98	
4	✓	20.14	80.50						
5	✓	20.12	100.62						
6	✓	20.12	120.74						
7	✓	20.11	140.85						
8	✓	20.13	160.98						
9	✓	20.12	181.1						
10	✓	20.11	201.21						
11	✓	20.12	221.33						
12	✓	20.12	241.45						
13	✓	20.13	261.58						
14	✓	20.12	281.70						
15	✓	20.11	301.81						
16	✓	20.11	321.92						
17	✓	20.12	342.04						
18	✓	20.13	362.17						
19	✓	20.12	382.29						
20	✓	20.11	402.40						
21	✓	20.11	422.51						
22	✓	20.12	442.63						
23	✓	20.13	462.76						
24	✓	20.11	482.87						
25	✓	20.11	502.98						
26	✓	20.13	523.11						
27	✓	20.13	543.24						
28	✓	20.13	563.37						
29	✓	20.12	583.49						
30	✓	20.12	603.61						

## SUMMARY OF TALLY

Total Length tallied:	663.98'
Casing Stick-Up:	4'
Length of Casing Cut-Off:	14.9'
Bottom of Well:	646'
Screened Interval:	—
Total Screen in Hole:	—

Notes:

8 3/8" OD LLS 0.250" wall thickness, beveled ends,  
8 3/16" ID  
ASTM A53

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-204</u>		Staff: <u>Jason Cook / David Huckle</u>	
Well ID: <u>N5A-014B</u>		Dates: <u>11-21-2014 to 11-23-2014</u>			
Total Well/Casing Depth: <u>1260</u> feet		Length of Rathole: <u>14</u> feet		Rat Hole Volume: <u>6.89</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>4.5</u> inches		Rat Hole Volume per foot: <u>0.492</u> Ft <sup>3</sup> /Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
4.5 inches	0.492 Ft <sup>3</sup> /Ft	1274-1260	10.8 inches	0.526 Ft <sup>3</sup> /Ft	700-360
9.5 inches	0.362 Ft <sup>3</sup> /Ft	1260-1230	11.25 inches	0.580 Ft <sup>3</sup> /Ft	360-100
10 inches	0.435 Ft <sup>3</sup> /Ft	1230-1140	13.75 inches	0.921 Ft <sup>3</sup> /Ft	100-40
10.25 inches	0.463 Ft <sup>3</sup> /Ft	1140-940	20.5 inches	2.182 Ft <sup>3</sup> /Ft	40-20
10.5 inches	0.491 Ft <sup>3</sup> /Ft	940-700	12.25 inches	6.708 Ft <sup>3</sup> /Ft	20-Surface

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	30	30	1194	1210	1200	1/4" x 10.8 Tacoma Super Sk
2	✓ 1740	17.4	47.4	1170	1170	1160	1/4" x 10.8 Tacoma Partial Super Sk
1	✓ 450	4.5	51.9	1159.7	1160	1140	9 bags of 10.20 x 10.40 Transition Sand
1	✓	153.1	205	835	-	820	19 bags of bentonite, 100 gallons of water,
2	✓	24.18	229.2	786	-	820	3 bags of bentonite grout, 175-200 gallons water
3	✓	24.49	253.7	736	-	760	4 bags of bentonite grout, 175-200 gallons water
4	✓	55.01	308.7	629	-	700	6 bags of bentonite grout, 400 gallons water
5	✓	24.18	332.9	583	-	640	3 bags of bentonite grout, 175-200 gallons of water
6	✓		351.0	537	-	580	
7	✓		381.2	491	-	520	
8	✓		405.4	443	-	460	

Notes:	Annular volume cubic feet per linear foot = (D <sup>2</sup> - d <sup>2</sup> ) x 0.005454
	ALL DEPTHS ARE FEET BELOW LAND SURFACE
	50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>
	Density of sand and gravel = 100 lbs/Ft <sup>3</sup>
	Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>
	Total Bags of Cement: <u>-</u>
	Total Bags of Bentonite Gel: <u>79</u>
	Total Bags of Bentonite Chips: <u>6 + 6</u>
	Total Bags of Transition Sand: <u>9</u>
	Total Super Sacks of Filter Pack: <u>~ 1.7 + 2.5</u>

# ANNULAR MATERIAL RECORD

Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
9	✓		24.18	429.6	349	-	600	3 bags bentonite grout, 175 200 gallons of water
10	✓			453.7	355	-	340	
11	✓			477.9	313	-	260	
12	✓			502.1	271	-	220	
13	✓			526.3	224	-		
14	✓			550.5	187	-		
15	✓			574.6	145	-		
16	✓			598.8	103	-		
17	✓			623.0	76	-		
18	✓			647.2	50	-		
19	✓			671.4	33	-		
20	✓		12.09	683.47	27	Surface	out of hole	1.5 bags bentonite, 80-100 gallons of water
								AFTER INSTALLATION OF GROUT TO SURFACE, DROPPED TO ~65 FEET BY 11/23
1	✓	-	4.2	687.7	60	-	-	3/8-INCH BENTONITE CHIPS (6 BAGS)
1	✓	3000	30.0	717.7	34	-	-	3/8-INCH PEA-GRAVEL (1 SK)
1	✓	-	3.5	721.2	32	-	-	3/8-INCH BENTONITE CHIPS (5 BAGS)
2,3	✓	4500	45	766.2	0	1	-	3/8-INCH PEA-GRAVEL (1.5 SKS)
1	✓	-	0.7	766.9	0	0	-	3/8-INCH BENTONITE CHIPS (1 BAG)

Notes:

## PIPE TALLY 4" CASING

Project Name.: <u>EX-152W</u>	Project No.: <u>30361 38681</u>
Well No.: <u>NSH-014B</u>	Date: <u>11/21/14</u>
Location: <u>NSH-DN</u>	Pipe Tally for: <u>Well Install</u>
Total Depth: <u>1260'</u>	Geologist: <u>J. Cook, D. Humber</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.05	20.05	4" screen	31	✓	20.07	621.77	4" BLANK
2	✓	20.06	40.11	↓	32	✓	20.04	641.81	
3	✓	20.10	60.21	↓	33	✓	20.07	661.88	
4	✓	20.08	80.29	↓	34	✓	20.04	681.92	
5	✓	20.01	100.3	4" blank	35	✓	20.01	701.93	
6	✓	20.03	120.33		36	✓	20.05	721.98	
7	✓	20.04	140.37		37	✓	20.10	742.08	
8	✓	20.02	160.39		38	✓	20.03	762.16	
9	✓	20.03	180.42		39	✓	20.07	782.23	
10	✓	20.07	200.49		40	✓	20.07	802.3	
11	✓	20.04	220.53		41	✓	20.06	822.36	
12	✓	20.08	240.6		42	✓	20.07	842.43	
13	✓	20.10	260.7		43	✓	20.01	862.44	
14	✓	20.08	280.78		44	✓	20.07	882.51	
15	✓	20.02	300.8		45	✓	20.03	902.54	
16	✓	20.07	320.87		46	✓	20.06	922.6	
17	✓	20.06	340.93		47	✓	20.06	942.66	
18	✓	20.06	360.99		48	✓	20.02	962.68	
19	✓	20.06	381.05		49	✓	20.02	982.7	
20	✓	20.05	401.1		50	✓	20.05	1002.73	
21	✓	20.08	421.18		51	✓	20.08	1022.81	
22	✓	20.05	441.23		52	✓	20.09	1042.9	
23	✓	20.05	461.28		53	✓	20.07	1062.97	↓
24	✓	20.03	481.31		SUMMARY OF TALLY Total Length tallied: 1263.47 ft Casing Stick-Up: _____ Length of Casing Cut-Off: _____ Bottom of Well: 1260 Screened Interval: 1180-1260 Total Screen in Hole: 80 ft				
25	✓	20.07	501.38						
26	✓	20.04	521.42						
27	✓	20.06	541.48						
28	✓	20.08	561.56						
29	✓	20.05	581.61						
30	✓	20.06	601.67	↓					

Notes:

Screen is 4.5" OD LCS Screen, 0.125" slots  
0.237 0.250 wall thickness(Casing is 4.5" OD LCS Pipe, 0.250 wall thickness  
0.237

#33 summed as 20.07 -DN

Project Name.: EX-1505	Project No.: 38681
Well No.: NSH-014B	Date: 11/21/14
Location: NSH-DN	Pipe Talley for: Well install
Total Depth: 12500'	Geologist: J. Cook, D. Hocken

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

[illegible]

Notes:

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-203</u>		Staff: <u>Kyle Mohr, Kendra Ford</u>	
Well ID: <u>NSH-015</u>		Dates: <u>11/13/14</u> , <u>11-24-14</u>			
Total Well/Casing Depth: <u>585</u> feet		Length of Rathole: <u>—</u> feet		Rat Hole Volume: <u>—</u> Ft³	
Well/Casing Diameter [d]: <u>8.625</u> inches		Rat Hole Volume per foot: <u>—</u> Ft³/Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>13</u> inches	<u>.52</u> Ft³/Ft	<u>585 - 0</u>		<u>—</u> inches Ft³/Ft	
<u>—</u> inches	<u>—</u> Ft³/Ft	<u>—</u>		<u>—</u> inches Ft³/Ft	
<u>—</u> inches	<u>—</u> Ft³/Ft	<u>—</u>		<u>—</u> inches Ft³/Ft	
<u>—</u> inches	<u>—</u> Ft³/Ft	<u>—</u>		<u>—</u> inches Ft³/Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	4.14	4.14	577.0	—	—	6 Bags Bentonite chips
1	✓	32.69	36.83	514.13	—	560	24 Bags cement, 1 bag quick gel, 1 bag call, ~200 gal water
1	✓	23.5	60.33	468.94	—	—	5-50 lb bags Bentonite, 150 gal water
2	✓	23.5	83.83	423.75	—	—	Same
3	✓	23.5	107.33	378.56	—	—	Same
4	✓	23.5	130.83	333.37	—	—	Same
5	✓	23.5	154.33	288.18	—	—	Same
6	✓	23.5	177.83	242.99	—	—	Same
7	✓	23.5	201.33	197.80	—	—	Same
8	✓	23.5	224.83	152.61	—	—	Same
9	✓	23.5	248.33	107.42	—	—	Same

Notes:	Annular volume cubic feet per linear foot = $(D^2 - d^2) \times 0.005454$	Total Bags of Cement: <u>24</u>
	ALL DEPTHS ARE FEET BELOW LAND SURFACE	Total Bags of Bentonite Gel: <u>80</u>
	50 lbs bag of bentonite chips = 0.7 Ft³	Total Bags of Bentonite Chips: <u>6 + 2</u>
	Density of sand and gravel = 100 lbs/Ft³	Total Bags of Transition Sand: <u>—</u>
	Full super sack (sk.) of filter pack is 30 Ft³	Total Super Sacks of Filter Pack: <u>1.75</u>

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Notes: 150 gal + 5-50 lb bags of Bentonite = 23.5 ft<sup>3</sup> → 45.19 ft<sup>3</sup>/lin. ft

86 Bags Bentonite Total, 24 Bags cement, 1 bag quick gel, 1 bag CaCl

## PIPE TALLY for Casing

Project Name.: <i>Excursion</i>	Project No.: <i>38681-203</i>
Well Site: <i>NSH-015</i>	Date: <i>11/13/14</i>
Location: <i>NSH-CJ</i>	Staff: <i>K. Mohr</i>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type		Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.13	20.13	8" casing						
2	✓	20.12	40.25							
3	✓	20.12	60.37							
4	✓	20.12	80.49							
5	✓	20.14	100.63							
6	✓	20.12	120.75							
7	✓	20.13	140.88							
8	✓	20.14	161.02							
9	✓	20.13	181.15							
10	✓	20.13	201.28							
11	✓	20.11	221.39							
12	✓	20.12	241.51							
13	✓	20.15	261.66							
14	✓	20.13	281.79							
15	✓	20.14	301.93							
16	✓	20.15	322.08							
17	✓	20.15	342.23							
18	✓	20.16	362.39							
19	✓	20.16	382.55							
20	✓	20.15	402.70							
21	✓	20.14	422.84							
22	✓	20.15	442.99							
23	✓	20.13	463.12							
24	✓	20.16	483.28							
25	✓	20.16	503.44							
26	✓	20.15	523.59							
27	✓	20.12	543.71							
28	✓	20.13	563.84							
29	✓	20.13	583.97							
30	✓	20.14	604.11	Cut off						
		- 17.42	⇒ 586.69							

**SUMMARY OF TALLY**

Total length of casing/screen tallied (ft.): 604.11

Length of casing cut off after landing (ft.): 17.42'

Bottom of Casing (feet, bls): 585.29

Stick up (ft, als): 1.40'

Screened Interval(s) (ft.bl's): \_\_\_\_\_

Total feet of screen in hole (ft.): \_\_\_\_\_

**Notes:**

Have 30 joints of casing expected to only use ~29  
TD ~ 582.2 feet



# ANNULAR MATERIAL RECORD

Project: Excavator

Project No.: 38681-203

Staff: Rylee Mahan

Well ID: NSA-016

Dates: 11/17/14, 11-24-14

Total Well/Casing Depth: 579.42 feet

Length of Rathole: — feet

Rat Hole Volume: — Ft<sup>3</sup>

Well/Casing Diameter [D]: 9.625 inches

Rat Hole Volume per foot: — Ft<sup>3</sup>/Lin. Ft

Borehole Diameter [D]: 13 inches      Annular Volume per Linear Foot: (interval) 580-0      Borehole Diameter [D]: — inches      Annular Volume per Linear Foot: (interval) — Ft<sup>3</sup>/Ft

— inches      — Ft<sup>3</sup>/Ft

— inches      — Ft<sup>3</sup>/Ft

— inches      — Ft<sup>3</sup>/Ft

— inches      — Ft<sup>3</sup>/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	4.2	4.2	571.34	—	560	6 bags Hole Plug ~ 8.08 ft <sup>3</sup> /lin ft size
1	✓	24.7	28.9	523.8	—	540	40 bags cement, 180 gal water, 1 bag CaCl <sub>2</sub> , 1/4 bag Quikrete gel
1	✓	21.4	50.3	482.7	—	500	6 bags Quikrete grout, 50 lbs 160 gal water
2	✓	21.4	71.7	441.5	—	500	6 bags Quikrete grout, 50 lbs
3	✓	21.4	93.1	400.3	—	460	6 bags Quikrete grout, 50 lbs
4	✓	21.4	114.5	359.1	—	460	6 bags - 50 lbs Quikrete grout
5	✓	21.4	135.9	317.9	—	380	6 bags - 50 lbs Quikrete grout
6	✓	21.4	157.3	276.7	—	380	6 bags - 50 lbs Quikrete grout
7	✓	21.4	178.7	235.5	—	300	6 bags - 50 lbs Quikrete grout
8	✓	21.4	200.1	194.3	—	300	6 bags - 50 lbs Bentonite
9	✓	23.5	223.6	149.1	—	220	5 bags - 50 lb Bentonite ~ 150 gal water

Notes: Annular volume cubic feet per linear foot = ( D<sup>2</sup> - d<sup>2</sup> ) x 0.005454

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>      7.48 ~ gal

Density of sand and gravel = 100 lbs/Ft<sup>3</sup>

Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement: 40

Total Bags of Bentonite Gel: 78

Total Bags of Bentonite Chips: 6 + 3

Total Bags of Transition Sand: —

Total Super Sacks of Filter Pack: 1.5

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**Notes:**

## PIPE TALLY 8" Casing

Project Name.: EXCELSIOR	Project No.: 33681
Well No.: NSH-016	Date: 11-16-14
Location: NSH-CI	Pipe Tally for: Casing (8")
Total Depth: 579'	Geologist: KENDRA FORD

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.13	20.13	8" CASING					
2	✓	20.13	40.26						
3	✓	20.14	60.40						
4	✓	20.13	80.53						
5	✓	20.13	100.66						
6	✓	20.13	120.79						
7	✓	20.14	140.93						
8	✓	20.13	161.06						
9	✓	20.12	181.18						
10	✓	20.12	201.30						
11	✓	20.13	221.43						
12	✓	20.13	241.56						
13	✓	20.12	261.68						
14	✓	20.12	281.80						
15	✓	20.13	301.93						
16	✓	20.12	322.05						
17	✓	20.12	342.17						
18	✓	20.13	362.30						
19	✓	20.11	382.41						
20	✓	20.12	402.53						
21	✓	20.14	422.67						
22	✓	20.14	442.81						
23	✓	20.12	462.93						
24	✓	20.14	483.07						
25	✓	20.11	503.18						
26	✓	20.10	523.28						
27	✓	20.13	543.41						
28	✓	20.13	563.54						
29	✓	20.13	583.67						
		←	← 4.25	579.42	SUMMARY OF TALLY Total Length tallied: 583.7' Casing Stick-Up: 0 Length of Casing Cut-Off: 4.3' Bottom of Well: 579' Screened Interval: - Total Screen in Hole: -				

Notes:

29 Joints of casing brought to site, ≈ 580 ft Totalling 583.67

4.25' at joint above top of surface casing  
 72' of Hole is 579.42'

# ANNULAR MATERIAL RECORD

Project: Excelsior

Project No.: 38681

Staff: KENNEDY FORD, KYLES MOHR

Well ID: N54-017

Dates: 12-5-14 to 12-7-14, 12-17-14

Total Well/Casing Depth: 1181 feet

Length of Rathole: 19 feet

Rat Hole Volume: 12.5 Ft<sup>3</sup>

Well/Casing Diameter [d]: 6.625 inches

Rat Hole Volume per foot: 0.660 Ft<sup>3</sup>/Lin. Ft

Borehole Diameter [D]: Annular Volume per Linear Foot: (interval)

Borehole Diameter [D]: Annular Volume per Linear Foot: (interval)

11 inches 0.660 Ft<sup>3</sup>/Ft RATHOLE

18 inches 1.53 Ft<sup>3</sup>/Ft 757-759'

11 inches 0.42 Ft<sup>3</sup>/Ft 930-1181'

13 inches 0.68 Ft<sup>3</sup>/Ft 61-757'

12 inches 0.55 Ft<sup>3</sup>/Ft 920-930' 759-920'

13.5 inches 0.75 Ft<sup>3</sup>/Ft 0-61'

         inches          Ft<sup>3</sup>/Ft         

         inches          Ft<sup>3</sup>/Ft         

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	20	20	1163	-	1173	1/4" net x No. 8 TACNA Filter Pack
	✓	10	30	1139	-	1133	
2	✓ 3000	6	36	1125	-	1093	
	✓	24	60	1068	-	1093	
3	✓ 3000	25	85	1008	-	1053	
	✓	5	90	996	-	1013	
4	✓ 3000	6	96	982	-	973	
	✓	24	120	925	940	973	
5	✓ 3000	2.7	122.7	934	936	913	(INSTALLING USING 5 GAL BUCKETS)
	✓	2.7	125.4	930	930.5	913	↓
	✓	0.9	126.3	928	929	913	↓

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>

Density of sand and gravel = 100 lbs/Ft<sup>3</sup>

Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement: 30

Total Bags of Bentonite Gel: 109

Total Bags of Bentonite Chips: 21

Total Bags of Transition Sand: 17

Total Super Sacks of Filter Pack: 425 + 7.25

# ANNULAR MATERIAL RECORD

Project : EXPLOR  
Well ID: NSH-017

Project No.: 38681  
Dates: 12-5-14 to 12-7-14, 12-17-14

Staff: KENNNA FORD, KYLE MOHR

Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
5	✓		1.3	127.6	928	931.5	913	USED A SWAB TO SÖTTE FILTER PACK
1	✓	550	5.5	133.1	920	924	913	1/4-INCH x No. 8 TACNA FILTER PACK
2	✓	300	3.0	136.1	919	918.5	913	No. 20-40 TRANSITION SAND (11 BAGS) ↓ (6 BAGS)
1			26.2	162.3	871	-	893	CEMENT-BENTONITE GROUT WITH GCL (30, 5 BAGS PORTLAND, 1 BAG GROUT, ~140 gals)
1	✓		20.1	182.4	834	-	833	BENTONITE GROUT (5 BAGS GROUT + 140 gals)
2	✓		22.4	204.8	794	-	833	(6 " + 155")
3	✓		20.1	224.9	757	-	833	(5 BAGS GROUT + 140 gals)
4	✓		20.1	245.0	732	-	833	
5	✓		20.1	265.1	702	-	833	
6	✓		20.1	285.2	673	-	733	
7	✓		20.1	305.3	643	-	733	
8	✓		20.1	325.4	614	-	733	
9	✓		20.1	345.5	584	-	733	
10	✓		20.1	365.6	554	-	733	
11	✓		20.1	385.7	524	-	533	
12	✓		20.1	405.8	495	-	533	
13	✓		20.1	425.9	466	-	533	
14	✓		20.1	446.0	436	-	533	
15	✓		20.1	466.1	406	-	533	

Notes:

# ANNULAR MATERIAL RECORD

[illegible]

## PIPE TALLY for 6" CASING

Project Name.: EXCELSIOR	Project No.: 38681
Well Site: NSH-017	Date: 12-5-14
Location: NSH-CK	Staff: KENDRA FORD, KYLE MOHR

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.06	20.06	6" screen	33	✓	20.07	663.19	
2	✓	20.06	40.12		34	✓	20.10	683.29	
3	✓	20.12	60.24		35	✓	20.08	703.37	
4	✓	20.08	80.32		36	✓	20.15	723.52	
5	✓	20.12	100.44		37	✓	20.08	743.60	
6	✓	20.12	120.56		38	✓	20.10	763.70	
7	✓	20.07	140.63		39	✓	20.08	783.78	
8	✓	20.07	160.70		40	✓	20.14	803.92	
9	✓	20.11	180.81		41	✓	20.11	824.03	
10	✓	20.08	200.89		42	✓	20.10	844.13	
11	✓	20.10	220.99		43	✓	20.08	864.21	
12	✓	20.08	241.07		44	✓	20.09	884.30	
13	✓	20.11	261.18	6" blank	45	✓	20.12	904.42	
14	✓	20.11	281.29		46	✓	20.08	924.50	
15	✓	20.11	301.40		47	✓	20.08	944.58	
16	✓	20.11	321.51		48	✓	20.11	964.69	
17	✓	20.13	341.64		49	✓	20.09	984.78	
18	✓	20.15	361.79		50	✓	20.12	1004.90	
19	✓	20.07	381.86		51	✓	20.07	1024.97	
20	✓	20.13	401.99		52	✓	20.12	1045.09	
21	✓	20.08	422.07		53	✓	20.09	1065.18	
22	✓	20.10	442.17		54	✓	20.08	1085.26	
23	✓	20.11	462.28		55	✓	20.14	1105.40	
24	✓	20.10	482.38		56	✓	20.08	1125.48	
25	✓	20.08	502.46		57	✓	20.08	1145.56	
26	✓	20.11	522.57		<b>SUMMARY OF TALLY</b> Total length of casing/screen tallied (ft.): <u>1185.8'</u> Length of casing cut off after landing (ft.): <u>5'</u> Bottom of Casing (feet, bls): <u>1180.8'</u> Stick up (ft, als): <u>5.0'</u> Screened Interval(s) (ft. bls): <u>940-1181'</u> Total feet of screen in hole (ft.): <u>241'</u>				
27	✓	20.13	542.70						
28	✓	20.08	562.78						
29	✓	20.09	582.87						
30	✓	20.09	602.96						
31	✓	20.08	623.04						
32	✓	20.08	643.12						

Notes:

Hang off top of screen @ 940'

Total screen 241.07 → Depth of 938.93 Must lower 1.07' to reach 940'

Casing Diameter .55' Casing wall .02'

401.99

Project Name.: EXC-310R	Project No.: 38681
Well Site: NSH-017	Date: 12-5-14
Location: NSH-CK	Staff: KENDRA FORD, KYLE MOHR

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

[illegible]



# ANNULAR MATERIAL RECORD

Project : <u>Excelsior</u>		Project No.: <u>38681-204</u>		Staff: <u>Jason Cook, Chad Price</u>	
Well ID: <u>N5H-018</u>		Dates: <u>12/6/14</u> ; <u>12/17/14</u> , <u>12-13-14</u> , <u>12-21-14</u>			
Total Well/Casing Depth: <u>991.74</u> feet		Length of Rathole: <u>5.21</u> feet		Rat Hole Volume: <u>2.3</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>4.5</u> inches (OD)		Rat Hole Volume per foot: <u>0.44</u> Ft <sup>3</sup> /Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>9.5</u> inches	<u>0.38</u> Ft <sup>3</sup> /Ft	<u>11.5</u> inches	<u>0.61</u> Ft <sup>3</sup> /Ft		
<u>10</u> inches	<u>0.43</u> Ft <sup>3</sup> /Ft	<u>12</u> inches	<u>0.67</u> Ft <sup>3</sup> /Ft		
<u>10.5</u> inches	<u>0.49</u> Ft <sup>3</sup> /Ft	<u>16"</u> inches		<u>904-911</u>	
<u>11</u> inches	<u>0.55</u> Ft <sup>3</sup> /Ft	<u>average ~ 12"</u> inches			

Super Sk. or Batch No.	✓	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	3000	30	30	914.9	925	920	Super Sack 1/4" x 10.8 Tacoma Filter Pack
2	✓	3000	30	60	813.8	-	890	"
3	✓	3000	30	90	752.6	830	820	"
4	✓	3000	30	120	767.8	756	760	"
5	✓	3000	30	150	694.7	-	680	"
6	✓	3000	30	180	633.5	670	670	"
7	✓	1045	10.45	190.45	598.7	598.75	600	Partial Super Sack 1/4" x 10.8 Tacoma Filter Pack
1	✓	450	4.5	194.95	584.6	590	585	4-50lb bags of No20x40 Transition Sand
2	✓	50	.5	195.45	589	589	585	1-50lb bag of No20x40 Transition Sand to get 10 Ft.
1	✓	700	7.8	205.25	569	575	555	14-50 lb bags hole Plug
2	✓	150	2.1	207.35	570	570	555	3-50 lb bags of hole Plug

Notes:	Annular volume cubic feet per linear foot = ( D <sup>2</sup> - d <sup>2</sup> ) x 0.005454
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>	
Density of sand and gravel = 100 lbs/Ft <sup>3</sup>	
Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>	
Total Bags of Cement:	-
Total Bags of Bentonite Gel:	-
Total Bags of Bentonite Chips:	17
Total Bags of Transition Sand:	10
Total Super Sacks of Filter Pack:	7 (8 super Sks fill) (+1.5 sks)

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PIPE TALLY for Casing & Screen

Project Name.: <u>Exelsior</u>	Project No.: <u>38681</u>
Well Site: <u>NSH-018</u>	Date: <u>12-7-14</u>
Location: <u>NSH-CV</u>	Staff: <u>T. Cook, C. Price</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.09		4" screen	33	✓	20.09	662.72	4" casing
2	✓	20.11	40.20		34	✓	20.06	682.78	
3	✓	20.06	60.26		35	✓	20.09	702.87	
4	✓	20.09	80.35		36	✓	20.07	722.94	
5	✓	20.15	100.50		37	✓	20.06	743.00	
6	✓	20.06	120.56		38	✓	20.03	763.03	
7	✓	20.13	140.69		39	✓	20.03	783.11	
8	✓	20.07	160.76		40	✓	20.07	803.18	
9	✓	20.10	180.86		41	✓	20.09	823.27	
10	✓	20.11	200.97		42	✓	20.07	843.34	
11	✓	20.12	221.09		43	✓	20.08	863.42	
12	✓	20.06	241.15		44	✓	20.12	883.54	
13	✓	20.13	261.28		45	✓	20.06	903.60	
14	✓	20.11	281.39		46	✓	20.03	923.63	
15	✓	20.08	301.47		47	✓	20.12	943.75	
16	✓	20.12	321.59		48	✓	20.14	963.89	
17	✓	20.06	341.65		49	✓	20.06	983.95	
18	✓	20.05	361.70		50	✓	20.04	1003.99	
19	✓	20.09	381.79						
20	✓	20.06	401.85	4" casing					
21	✓	20.07	421.92						
22	✓	20.05	441.97						
23	✓	20.07	462.04						
24	✓	20.07	482.11						
25	✓	20.03	502.14						
26	✓	20.06	522.20						
27	✓	20.10	542.30						
28	✓	20.03	562.33						
29	✓	20.06	582.39						
30	✓	20.08	602.47						
31	✓	20.08	622.55						
32		20.08	642.63						
					SUMMARY OF TALLY				
					Total length of casing/screen tallied (ft.): <u>1004</u>				
					Length of casing cut off after landing (ft.): <u>11</u>				
					Bottom of Casing (feet, bls): <u>992</u>				
					Stick up (ft, als): <u>1</u>				
					Screened Interval(s) (ft. bls): <u>610-992</u>				
					Total feet of screen in hole (ft.): <u>382</u>				

## Notes:

Bull nose plug 0.21'

12.2' stick up to land screen at 610

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681-2014</u>		Staff: <u>KENDRA FORD</u>	
Well ID: <u>NS 14-019</u>		Dates: <u>12-9-14, 12-21-14</u>			
Total Well/Casing Depth: <u>638</u> feet		Length of Rathole: <u>—</u> feet		Rat Hole Volume: <u>—</u> Ft³	
Well/Casing Diameter [d]: <u>8 5/8"</u> inches		Rat Hole Volume per foot: <u>—</u> Ft³/Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>13"</u> inches	<u>0.51</u> Ft³/Ft	<u>20 - 638 ft</u>		<u>—</u> Ft³/Ft	
<u>13.5</u> inches	<u>0.59</u> Ft³/Ft	<u>0 - 20 ft</u>		<u>—</u> Ft³/Ft	
<u>—</u> inches	<u>—</u> Ft³/Ft	<u>—</u>		<u>—</u> Ft³/Ft	
<u>—</u> inches	<u>—</u> Ft³/Ft	<u>—</u>		<u>—</u> Ft³/Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	3.5	3.5	631.14	-	619.33	5 bags bentonite chips = 6.86 Ft rise
1	✓	26.74	26.74	578.71	-	619.33	35 bags Quik-Gel, 15 bag Peci, 52.43 Ft rise
1	✓	18.71	18.71	542.01	-	559.30	5 bags Quik-Gel, 140 gal = 36.70 Ft rise
2	✓	18.71	37.42	505.31	-	"	"
3	✓	18.71	56.13	468.61	-	"	"
4	✓	18.71	74.84	431.91	-	"	"
5	✓	18.71	93.55	395.21	-	459.25	"
6	✓	18.71	112.26	358.51	-	"	"
7	✓	18.71	130.97	321.81	-	"	"

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft³

Density of sand and gravel = 100 lbs/Ft³

Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement: 35

Total Bags of Bentonite Gel: 70 (Quik Gel)

Total Bags of Bentonite Chips: 15

Total Bags of Transition Sand: —

Total Super Sacks of Filter Pack: 4.5

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Staff: KENDRA FORD

Dates: 12-9-14, 12-21-14

Notes:



## PIPE TALLY 8" Casing

Project Name.: <u>Excelsior</u>	Project No.: <u>38681-204</u>
Well No.: <u>NH-019</u>	Date: <u>12-9-14</u>
Location: <u>NSH-DA</u>	Pipe Tally for: <u>8" casing</u>
Total Depth: <u>638 FEET</u>	Geologist: <u>Kyle Mohr</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.12	20.12	8" casing	31	✓	20.14	624.15	8" casing
2	✓	20.14	40.26		32	✓	20.11	644.26	" "
3	✓	20.15	60.41						
4	✓	20.13	80.54						
5	✓	20.14	100.68						
6	✓	20.14	120.82						
7	✓	20.14	140.96						
8	✓	20.14	161.10						
9	✓	20.13	181.23						
10	✓	20.14	201.37						
11	✓	20.13	221.50						
12	✓	20.13	241.63						
13	✓	20.13	261.76						
14	✓	20.13	281.89						
15	✓	20.13	302.02						
16	✓	20.15	322.17						
17	✓	20.13	342.3						
18	✓	20.13	362.43						
19	✓	20.14	382.57						
20	✓	20.12	402.69						
21	✓	20.14	422.83						
22	✓	20.13	442.96						
23	✓	20.13	463.09						
24	✓	20.13	483.22						
25	✓	20.14	503.36						
26	✓	20.13	523.49						
27	✓	20.14	543.63						
28	✓	20.14	563.77						
29	✓	20.13	583.90						
30	✓	20.11	604.01						
					SUMMARY OF TALLY				
					Total Length tallied: <u>644.26</u>				
					Casing Stick-Up: <u>1.20'</u>				
					Length of Casing Cut-Off: <u>5.02'</u>				
					Bottom of Well: <u>638.04'</u>				
					Screened Interval: <u>-</u>				
					Total Screen in Hole: <u>-</u>				

Notes:

Casing Diameter - 8 5/8" LOW-CARBON STEEL  
Casing wall ~ 1/4"

Cut off 5.02 ft

# ANNULAR MATERIAL RECORD

Project: <u>Exelsior</u>		Project No.: <u>38681</u>		Staff: <u>SCook, C Price</u>	
Well ID: <u>N5H 020</u>		Dates: <u>12-17 to 12-20-2014, 12-24-14</u>			
Total Well/Casing Depth: <u>1581.7</u> feet		Length of Rathole: <u>13.3</u> feet		Rat Hole Volume: <u>7.0</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>4.5" OD</u> inches		Rat Hole Volume per foot: <u>0.53</u> Ft <sup>3</sup> /Lin. Ft		TD ~ <u>1595</u>	
Borehole Diameter [D]: Annular Volume per Linear Foot: (interval)		Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)	
9 7/8 inches	0.42 Ft <sup>3</sup> /Ft	TD - 1130	inches		Ft <sup>3</sup> /Ft
<u>wash 2.0" x 2.0" inches</u>	<u>0.43</u> Ft <sup>3</sup> /Ft	<u>1253 - 1263</u>	inches		Ft <sup>3</sup> /Ft
<u>10" inches</u>	<u>0.43</u> Ft <sup>3</sup> /Ft	<u>1130 - 0</u>	inches		Ft <sup>3</sup> /Ft
			inches		Ft <sup>3</sup> /Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	30	30	1527	1525	1580 - 1480	1/4" x NO. 8 Tarna Filter pack,
2	✓ 2800	28	58	1458	1450	1480 - 1460	1/4" x NO. 8 Tarna filter P k
3	✓ 750	10.5	68.5	1434	—	1415	15 bags of H
4	✓ 750	3.5	72.0	1426	1414 off	1395	5 bags of hole Plug
5	✓ 100	1.4	73.4	1423	1425		2 f Plug
6	✓ 450	6.3	79.7	1410	1406 Tremie		9 bags of 10
7	✓ 3000	30	109.7	1235	—	1315	1/4" x NO. 8 Tarna Filter Pack
8	✓ 3000	30	139.7	1264	1264	1275	1/4" x NO. 8 Tarna Filter Pack
9	✓ 2250	22.5	162.2	~1250	71255	1235	1/4" x NO. 8 Tarna Filter Pack
10	✓ 3000	30	192.2	~1250	71255	1235	1/4" x NO. 8 Tarna Filter Pack
11	✓ 3000	30	222.2	~1250	71255	1235	1/4" x NO. 8 Tarna Filter Pack

Notes: Annular volume cubic feet per linear foot = (D <sup>2</sup> - d <sup>2</sup> ) x 0.005454	
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>	
Density of sand and gravel = 100 lbs/Ft <sup>3</sup>	
Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>	

Total Bags of Cement:	—
Total Bags of Bentonite Gel:	132
Total Bags of Bentonite Chips:	41 + 13
Total Bags of Transition Sand:	8
Total Super Sacks of Filter Pack:	13 1/3 + 5

# ANNULAR MATERIAL RECORD

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Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
8	✓	3000	30	252.2	~1250	71255	1235	
9	✓	3000	30	282.2	~1250	1265		
10	✓	3000	30	312.2	~1250	1264	1235	1/4" x NO. 8 Tacon Filter Pack
11	✓	3000	30	342.2	~1250	—	1235	1/4" x NO. 8 Tacon Filter Pack
12	✓	1000	10	352.2	~1250	1227	1235	1/3 sk 1/4" x NO. 8 Tacon
13	✓	500	7.0	359.2	1211	1202	1175	10 bags hole plug
14	✓	3000	30	389.2	1133	—	1140-1100	1/4" NO. 8 Tacon Filter Pack
15	✓	3000	30	419.2	~1065	1065	1100-1060	1/4" NO. 8 Tacon Filter Pack
16	✓	1000	10	429.2	~1050	1053	1060	1/4" NO. 8 Tacon Filter Pack
17	✓	1000	10	430.3	1050	1050	1040	8 bags - 50 lb. Colorado Silica Sand
18	✓	330 gal	44.1	478.4	930	—	1000-760	1.10 g/m³ 44 mix, 12 bags mix, 330 g
19	✓	330 gal	44.1	422.5	827	—	760-460	1.10 g/cm³ grout mix, 12 bags mix, 330
20	✓	330 gal	44.1	466.6	724	—	4	1 g out mix 12 bags mix 3
21	✓	330 gal	44.1	510.7	621	—	Surf. Face	1.10 g/m³ grout mix 12 bags - 330 gallon
22	✓	1980 gal	264.6	775.3	6	—	Surf. Face	(6 Batches) 1.10 g/cm³ grout mix, 12 bags, 330 gal
23	✓	330 gal	44.1	819.4	+97.2	—	Surf. Face	1.10 g/cm³ grout mix 12 bags, 330 gal
24	✓				~340	—	—	CALCULATED 12/21/14
25	✓	6000	8.4	827.8	~320	—	—	3/8-INCH BENTONITE CHIPS (12 BAGS)
26	✓	15,000	150	977.8	0	1.0	—	1/4" x NO. 8 TACNA GRANULE (5 SUPER SACKS)
27	✓	50	0.7	978.5	0	0	—	3/8-INCH BENTONITE CHIPS (1 BAG)

Notes: Batch S-10 is 6 Batches. all of 12 bags of Bentonite (Quick Grout).



PIPE TALLY for 4 1/2" well casing

Project Name.: <u>Excelsior</u>	Project No.: <u>3868N</u>
Well Site: <u>NSH-020</u>	Date: <u>12-16-14</u>
Location: <u>NSH-CX</u>	Staff: <u>L Price + Jason Coul</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.07	20.07	screen <sup>bull nose plug</sup>	33	✓	20.11	642.29	Blank
2	✓	20.09	40.16	screen	34	✓	20.07	662.36	
3	✓	20.09	60.25	screen	35	✓	20.08	682.44	
4	✓	20.11	80.36	screen	36	✓	20.10	702.54	
5	✓	20.11	100.47	screen	37	✓	20.12	722.66	
6	✓	9.53	110.00	screen	38	✓	20.07	742.73	
7	✓	20.06	130.06	Blank	39	✓	20.08	762.81	
8	✓	20.09	150.15	Blank	40	✓	20.09	782.90	
9	✓	20.11	170.26	Blank	41	✓	20.07	802.97	
10	✓	9.74	180.00	Blank	42	✓	20.08	823.05	
11	✓	20.10	200.10	Screen	43	✓	20.09	843.14	
12	✓	20.10	220.20	screen	44	✓	20.07	863.21	
13	✓	20.14	240.34	screen	45	✓	20.06	883.27	
14	✓	20.14	260.48	screen	46	✓	20.07	903.34	
15	✓	20.12	280.60	screen	47	✓	20.10	923.44	
16	✓	20.08	300.68	screen	48	✓	20.07	943.51	
17	✓	20.13	320.81	screen	49	✓	20.07	963.58	
18	✓	20.09	340.90	screen	50	✓	20.09	983.67	
19	✓	20.10	361.00	Blank	51	✓	20.07	1003.74	
20	✓	20.10	381.10	Blank	52	✓	20.08	1023.82	
21	✓	20.10	401.20	Blank	53	✓	20.06	1043.88	
22	✓	20.09	421.29	screen	54	✓	20.06	1063.94	
23	✓	20.05	441.34	screen	55	✓	20.07	1084.01	
24	✓	20.08	461.42	screen	56	✓	20.08	1104.09	
25	✓	20.09	481.51	screen	57	✓	20.13	1124.22	
26	✓	20.11	501.62	screen	<b>SUMMARY OF TALLY</b> Total length of casing/screen tallied (ft.): <u>1585.93</u> Length of casing cut off after landing (ft.): <u>3.2'</u> Bottom of Casing (feet, bls): <u>1582'</u> Stick up (ft, als): <u>~1 ft</u> Screened Interval(s) (ft. bls): <u>1582-1472 : 1402-1241 : 1181-1060</u> Total feet of screen in hole (ft.): <u>392'</u>				
27	✓	20.11	521.73	screen					
28	✓	20.10	541.83	Blank					
29	✓	20.06	561.89						
30	✓	20.13	582.02						
31	✓	20.07	602.09						
32	✓	20.09	622.18						

Notes:

4 1/2" OD LCS - ASTM A53B4" IDBull nose plug - 2 1/2"Centralizers on pipe #1 + #64.20' stickup needed @ landing



PIPE TALLY for 4 1/2" well casing

Project Name.: Excelsior	Project No.: 38681
Well Site: NSH-020	Date: 12-16-14
Location: NSH-CX	Staff: C Price

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

[illegible]

Notes:

Notes: landing joint needs 4.20' stick up for 1<sup>st</sup> screened interval to hit @ 1060'

## ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>	Project No.: <u>38681</u>	Staff: <u>Jordan Nielsen</u>
Well ID: <u>NSTH-021 b</u>	Dates: <u>1/9/14</u>	
Total Well/Casing Depth: <u>1260</u> feet	Length of Rathole: <u>NA</u> feet	Rat Hole Volume: <u>NA</u> Ft <sup>3</sup>
Well/Casing Diameter [d]: <u>8</u> inches	Rat Hole Volume per foot: <u>NA</u> Ft <sup>3</sup> /Lin. Ft	
Borehole Diameter [D]: <u>7 1/2</u> inches	Annular Volume per Linear Foot: (interval)	Annular Volume per Linear Foot: (interval)
<u>8</u> inches	<u>42.60 - 61.7</u> Ft <sup>3</sup> /Ft	<u>NA</u> Ft <sup>3</sup> /Ft
<u>0.35</u> inches	<u>61.7 - 0</u> Ft <sup>3</sup> /Ft	<u>NA</u> Ft <sup>3</sup> /Ft
<u>0</u> inches	<u>0</u> Ft <sup>3</sup> /Ft	<u>NA</u> Ft <sup>3</sup> /Ft
<u>0</u> inches	<u>0</u> Ft <sup>3</sup> /Ft	<u>NA</u> Ft <sup>3</sup> /Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	32.2	32.2	1152		1175	11.4 lb/gal, 21-47 lb cement, 2-50 lb quick gel, 100 gal
2	✓	28.3	60.5	1061		1175	12.0 lb/gal, 21-47 lb cement, 2-50 lb quick gel, 167 gal
3	✓	26.5	89.0	969		1095	12.1 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 168 gal
4	✓	28.5	117.5	877		1095	12.1 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 175 gal
5	✓	28.5	146.0	785		895	12.1 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 168 gal
6	✓	27.8	173.8	695		815	12.2 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 163 gal
7	✓	24.4	196.4	616		735	12.7 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 158 gal
8	✓	24.4	223.0	546		635	12.7 lb/gal, 23-47 lb cement, 2-50 lb quick gel, 158 gal

Notes:	Annular volume cubic feet per linear foot = $(D^2 - d^2) \times 0.005454$
	Total Bags of Cement: <u>182</u>
	Total Bags of Bentonite Gel: <u>16</u>
	Total Bags of Bentonite Chips:
	Total Bags of Transition Sand:
	Total Super Sacks of Filter Pack:

# ANNULAR MATERIAL RECORD

Project: <u>EXCELSIOR</u>		Project No.: _____		Staff: <u>KENDRA FORD, KYLE MOHR</u>	
Well ID: <u>NSH-0216</u>		Dates: <u>12-18-14</u>			
Total Well/Casing Depth: <u>616.81</u> feet		Length of Rathole: _____ feet		Rat Hole Volume: _____ Ft³	
Well/Casing Diameter [d]: <u>8.5</u> inches		Rat Hole Volume per foot: _____ Ft³/Lin. Ft			
Borehole Diameter [D]: _____ inches		Borehole Diameter [D]: _____ inches		Annular Volume per Linear Foot: (interval)	
13 _____ inches		0 to 616.81 ft		Ft³/Ft	
_____ inches		_____		Ft³/Ft	
_____ inches		_____		Ft³/Ft	
_____ inches		_____		Ft³/Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1 ✓		3.5	3.5	616.81	-		5 bags hole plug (inside casing)
15 ✓		28.07	28.07	566.68	-	599.43	38 bags cement; 1.5 bags CaCl; 140 gal water
16 ✓							- total volume ~ 210 gal (21 inches) → 50.13 ft rise
1 ✓		23.6	23.6	524.62	-	539.40	5 bags bentonite gel, 165 gal water → 42.06 ft rise
2 ✓		23.6	47.2	482.56	-	"	"
3 ✓		23.6	70.8	440.50	-	"	"
4 ✓		23.6	94.4	398.44	-	479.37	"
5 ✓		23.6	118	356.38	-	"	"

Notes: Annular volume cubic feet per linear foot = (D² - d²) x 0.005454		Total Bags of Cement: <u>38</u>
ALL DEPTHS ARE FEET BELOW LAND SURFACE		Total Bags of Bentonite Gel: <u>75</u>
50 lbs bag of bentonite chips = 0.7 Ft³		Total Bags of Bentonite Chips: <u>5</u>
Density of sand and gravel = 100 lbs/Ft³		Total Bags of Transition Sand: _____
Full super sack (sk.) of filter pack is 30 Ft³		Total Super Sacks of Filter Pack: _____

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## PIPE TALLY

Project Name.: <u>Excelsior</u>	Project No.: <u>3881-204</u>
Well No.: <u>NSH-0216</u>	Date: <u>12-17-14</u>
Location: <u>NSH-DB</u>	Pipe Talley for: <u>8" casing</u>
Total Depth: <u>617 Feet</u>	Geologist: <u>Nyle Mohr, Kendra Ford</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.13	20.13	8" casing	31	✓	20.12	624.04	8" csg
2	✓	20.14	40.27						
3	✓	20.12	60.39						
4	✓	20.14	80.53						
5	✓	20.14	100.67						
6	✓	20.13	120.80						
7	✓	20.12	140.92						
8	✓	20.12	161.04						
9	✓	20.12	181.16						
10	✓	20.13	201.29						
11	✓	20.13	221.42						
12	✓	20.13	241.55						
13	✓	20.14	261.69						
14	✓	20.13	281.82						
15	✓	20.13	301.95						
16	✓	20.14	322.09						
17	✓	20.13	342.22						
18	✓	20.13	362.35						
19	✓	20.13	382.48						
20	✓	20.13	402.61						
21	✓	20.13	422.74						
22	✓	20.13	442.87						
23	✓	20.14	463.01						
24	✓	20.14	483.15						
25	✓	20.13	503.28						
26	✓	20.13	523.41						
27	✓	20.14	543.55						
28	✓	20.11	563.66						
29	✓	20.13	583.79						
30	✓	20.13	603.92						
					SUMMARY OF TALLY				
					Total Length tallied: <u>624.04</u>				
					Casing Stick-Up: <u>2.63</u>				
					Length of Casing Cut-Off: <u>4.60</u>				
					Bottom of Well: <u>616.81</u>				
					Screened Interval: <u>        </u>				
					Total Screen in Hole: <u>        </u>				

Notes:

8" casing → 8 5/8" diameter 1/4" wall

# ANNULAR MATERIAL RECORD

Project: <u>EXCAVATOR</u>		Project No.: <u>38681</u>		Staff: <u>J. NELSON</u>	
Well ID: <u>NSH-021C</u>		Dates: <u>1-11-15 to 1-12-15</u>			
Total Well/Casing Depth: <u>624</u> feet		Length of Rathole: <u>0</u> feet		Rat Hole Volume: <u>0</u> Ft <sup>3</sup>	
Well/Casing Diameter [d]: <u>8.625</u> inches		Rat Hole Volume per foot: <u>0</u> Ft <sup>3</sup> /Lin. Ft			
Borehole Diameter [D]: <u>13</u> inches		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
<u>0.52</u> Ft <sup>3</sup> /Ft		<u>20-624'</u>		<u>0</u> Ft <sup>3</sup> /Ft	
<u>0</u> Ft <sup>3</sup> /Ft				<u>0</u> Ft <sup>3</sup> /Ft	
<u>0</u> Ft <sup>3</sup> /Ft				<u>0</u> Ft <sup>3</sup> /Ft	
<u>0</u> Ft <sup>3</sup> /Ft				<u>0</u> Ft <sup>3</sup> /Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	6.3	6.3	617	-	-	3/8" INH BENTONITE CHIPS INSTALLED IN OPEN BOREHOLE (9 BAGS)
1	✓	28.8	35.1	562	-	599	NEAT CEMENT (37 BAGS PORTLAND + ~150 GALS WATER, 13.9 lbs./gal)
1	✓	21.5	56.6	521	-	499	BENTONITE GROUT (5 BAGS GEL + 150 gal water) ~9.3 lbs./gal
2	✓	21.5	78.1	479	-	499	
3	✓	21.5	99.6	438	-	499	
4	✓	21.5	121.1	397	-	439	
5	✓	21.5	142.6	356	-	379	
6	✓	21.5	164.1	314	-	379	
7	✓	21.5	185.6	273	-	339	

Notes: Annular volume cubic feet per linear foot = ( D <sup>2</sup> - d <sup>2</sup> ) x 0.005454	
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup>	
Density of sand and gravel = 100 lbs/Ft <sup>3</sup>	
Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>	

Total Bags of Cement:	<u>37</u>
Total Bags of Bentonite Gel:	<u>70</u>
Total Bags of Bentonite Chips:	<u>9</u>
Total Bags of Transition Sand:	<u>0</u>
Total Super Sacks of Filter Pack:	<u>0</u>

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## PIPE TALLY 8" CASING

Project Name.: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-021C</u>	Date: <u>1-11-15</u>
Location: <u>NSH-DB</u>	Pipe Talley for: <u>8" CASING</u>
Total Depth: <u>624</u>	Geologist: <u>K FORD</u>

Type of Connections: ☐ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.12	20.12	8" csg	31	✓	20.03	623.73	8" csg
2	✓	20.12	40.24		32	✓	4.08	627.81	includes stickup *
3	✓	20.12	60.36						
4	✓	20.15	80.51						
5	✓	20.12	100.63						
6	✓	20.13	120.76						
7	✓	20.13	140.89						
8	✓	20.12	161.01						
9	✓	20.12	181.13						
10	✓	20.12	201.25						
11	✓	20.13	221.38						
12	✓	20.14	241.52						
13	✓	20.13	261.65						
14	✓	20.12	281.77						
15	✓	20.14	301.91						
16	✓	20.11	322.02						
17	✓	20.11	342.13						
18	✓	20.12	362.25						
19	✓	20.12	382.37						
20	✓	20.13	402.50						
21	✓	20.12	422.62						
22	✓	20.12	442.74						
23	✓	20.12	462.86						
24	✓	20.11	482.97						
25	✓	20.12	503.09						
26	✓	20.12	523.21						
27	✓	20.12	543.33						
28	✓	20.14	563.47						
29	✓	20.14	583.61						
30	✓	20.09	603.70						
					SUMMARY OF TALLY				
					Total Length tallied: <u>627.8</u>				
					Casing Stick-Up: <u>0</u>				
					Length of Casing Cut-Off: <u>3.8</u>				
					Bottom of Well: <u>624.0</u>				
					Screened Interval: <u>-</u>				
					Total Screen in Hole: <u>-</u>				

Notes:

1-11-15 - Brought over / laid out 31 joints + measured.  
\* A portion of this joint will be cut off

# ANNULAR MATERIAL RECORD

Project: <u>EXCELSIOR</u>		Project No.: <u>38681</u>		Staff: <u>C. PRICE, S. NIELSEN</u>	
Well ID: <u>NGH-022</u>		Dates: <u>1-18-15 to 1-19-15</u>			
Total Well/Casing Depth: <u>1131</u> feet		Length of Rathole: <u>39</u> feet		Rat Hole Volume: <u>28.1</u> Ft³	
Well/Casing Diameter [d]: <u>6.625</u> inches		Rat Hole Volume per foot: <u>0.72</u> Ft³/Lin. Ft			
Borehole Diameter [D]:		Annular Volume per Linear Foot: (interval)		Borehole Diameter [D]:	
<u>11.5</u> inches	<u>0.72</u> Ft³/Ft	<u>1131-1170' RAT HOLE</u>	<u>30</u> inches	<u>4.67</u> Ft³/Ft	<u>1018-1022</u>
<u>11.625</u> inches	<u>0.50</u> Ft³/Ft	<u>1045-1131</u>	<u>12</u> inches	<u>0.55</u> Ft³/Ft	<u>613-1018</u>
<u>~12</u> inches	<u>0.55</u> Ft³/Ft	<u>1030-1045</u>	<u>12.5</u> inches	<u>0.61</u> Ft³/Ft	<u>333-613</u>
<u>21</u> inches	<u>2.17</u> Ft³/Ft	<u>022-1030</u>	<u>13</u> inches	<u>0.63</u> Ft³/Ft	<u>319-339</u>

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 3000	30.0	30.0	1127	1115	~1160, 1120	1/4-INCH x No. 8 TACNA FILTER PACK
2	✓ 3000	30.0	60.0	1055	1037	~1080, 1040	↓
3	✓ 3000	30.0	90.0	1018	1017	~1020	↓
4	✓ 3000	30.0	120.0	962	997	~1000	↓
1	✓ 450	4.5	124.5	989	991	985	No. 20-40 SILICA SAND (50lb BAGS)
2	✓ 1000	6.0	130.5	780	989	975	↓
3	✓ 500	5.0	135.5	980	972	975	↓
1	✓ -	48.9	184.4	886	-	900	BENTONITE GROUT (10x50lb BAGS + ~340 gal WATER)
2	✓ -	19.6	204.0	851	-	900	(4x50lb BAGS + ~140 GAL WATER)
3	✓ -	24.5	228.5	806	-	840	(5x50lb BAGS + ~170 GAL WATER)
4	✓ -	24.5	253.0	761	-	840	↓

Notes:	Annular volume cubic feet per linear foot = $(D^2 - d^2) \times 0.005454$
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft³	
Density of sand and gravel = 100 lbs/Ft³	
Full super sack (sk.) of filter pack is 30 Ft³	

Total Bags of Cement:	<u>119</u>
Total Bags of Bentonite Gel:	<u>119</u>
Total Bags of Bentonite Chips:	<u>31</u>
Total Bags of Transition Sand:	<u>4</u>
Total Super Sacks of Filter Pack:	<u>4</u>

BH DIA	ANN. VOL.	INTERVAL
<u>14</u>	<u>0.83</u>	<u>293-319 FT</u>
<u>12.5</u>	<u>0.61</u>	<u>46-293 FT</u>
<u>13.5</u>	<u>0.75</u>	<u>0-46 FT</u>

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Staff: C. PECE, J. NIELSON

Dates: 1-18-15 to 1-19-15

[illegible]

**Notes:**

## PIPE TALLY for Well Casing

Project Name.: <u>Excelsior</u>	Project No.: <u>38681</u>
Well Site: <u>NSH-022</u>	Date: <u>11/17/15</u>
Location: <u>NSH-BF</u>	Staff: <u>J. Nielsen; C. Price</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	0.25	0.25	Bull Nose End Cap	33	✓	20.09	643.34	Blank
2	✓	20.12	20.37	Screen	34	✓	20.14	663.48	
3	✓	20.08	40.45		35	✓	20.10	683.58	
4	✓	20.12	60.57		36	✓	20.09	703.67	
5	✓	20.07	80.64		37	✓	20.11	723.78	
6	✓	20.12	100.76		38	✓	20.11	743.89	
7	✓	20.09	120.85		39	✓	20.07	763.96	
8	✓	20.09	140.94	Blank	40	✓	20.09	784.05	
9	✓	20.11	161.05		41	✓	20.11	804.16	
10	✓	20.08	181.13		42	✓	20.14	824.30	
11	✓	20.06	201.19		43	✓	20.13	844.43	
12	✓	20.10	221.29		44	✓	20.11	864.54	
13	✓	20.09	241.38		45	✓	20.09	884.63	
14	✓	20.09	261.47		46	✓	20.09	904.72	
15	✓	20.11	281.68		47	✓	20.08	924.80	
16	✓	20.08	301.66		48	✓	20.09	944.89	
17	✓	20.12	321.78		49	✓	20.07	964.96	
18	✓	20.04	341.82		50	✓	20.11	985.07	
19	✓	20.08	361.90		51	✓	20.11	1005.18	
20	✓	20.13	382.03		52	✓	20.07	1025.25	
21	✓	20.12	402.15		53	✓	20.09	1045.34	
22	✓	20.13	422.28		54	✓	20.08	1065.42	
23	✓	20.12	442.40		55	✓	20.10	1085.52	
24	✓	20.09	462.49		56	✓	20.07	1105.59	
25	✓	20.09	482.58		57	✓	20.08	1125.67	
26	✓	20.12	502.70		58	✓	20.08	1145.75	
27	✓	20.09	522.79		SUMMARY OF TALLY				
28	✓	20.14	542.93		Total length of casing/screen tallied (ft.): <u>1145.75</u>				
29	✓	20.06	562.99		Length of casing cut off after landing (ft.): <u>12.60</u>				
30	✓	20.06	583.05		Bottom of Casing (feet, bls): <u>1130.85</u>				
31	✓	20.11	603.16		Stick up (ft, als): <u>2.30</u>				
32	✓	20.09	623.25		Screened Interval(s) (ft.bl): <u>1130.85 - 1010.00</u>				
					Total feet of screen in hole (ft.): <u>120.85</u>				

## Notes:

8 screen joints onsite - used 6  
 51 blank joints onsite

LCS 6 5/8" OD ; 6 1/8" ID

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Project : <u>Enochian</u>		Project No.: <u>39681</u>		Staff: <u>R. Kruger</u>			
Well ID: <u>NSH-023</u>		Dates: <u>11/16/15</u>					
Total Well/Casing Depth: <u>625</u> feet		Length of Rathole: _____ feet		Rat Hole Volume: _____ Ft <sup>3</sup>			
Well/Casing Diameter [d]: <u>8.625</u> inches		Rat Hole Volume per foot: _____ Ft <sup>3</sup> /Lin. Ft					
Borehole Diameter [D]: _____ inches		Annular Volume per Linear Foot: (interval) _____ Ft <sup>3</sup> /Ft		Annular Volume per Linear Foot: (interval) _____ Ft <sup>3</sup>			
<u>13</u> inches		<u>0.52</u> Ft <sup>3</sup> /Ft		_____ Ft <sup>3</sup> /Ft			
_____ inches		_____ Ft <sup>3</sup> /Ft		_____ Ft <sup>3</sup> /Ft			
_____ inches		_____ Ft <sup>3</sup> /Ft		_____ Ft <sup>3</sup> /Ft			
_____ inches		_____ Ft <sup>3</sup> /Ft		_____ Ft <sup>3</sup> /Ft			
<u>1</u> <u>500</u> <u>7</u> <u>612</u> <u>10x 50 lbs Hole Plug</u>							
Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
<u>1</u>	<u>✓</u> <u>1550</u>	<u>28</u>	<u>35</u>	<u>545</u>		<u>620</u>	<u>30 bags cement 50lb each; Na Chloride; 1 gal</u>
<u>1</u>	<u>✓</u> <u>480</u>	<u>21</u>	<u>56</u>	<u>505</u>		<u>580</u>	<u>8 bags GROUT Well DF; 9.2 lbs/gal</u>
<u>2</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>79.5</u>	<u>460</u>		<u>580</u>	<u>16 bags G.W.D.F.; 9.3 lbs/gal</u>
<u>3</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>103</u>	<u>415</u>		<u>520</u>	<u>6 bags G.W.D.F.; 9.3 lbs/gal</u>
<u>4</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>126.5</u>	<u>370</u>		<u>520</u>	<u>6 G.W.D.F.; 9.3 lbs/gal</u>
<u>5</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>150</u>	<u>325</u>		<u>420</u>	<u>6 G.W.D.F.; 9.3 lbs/gal</u>
<u>6</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>173.5</u>	<u>280</u>		<u>420</u>	<u>6 G.W.D.F.; 9.3 lbs/gal</u>
<u>7</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>197</u>	<u>235</u>		<u>420</u>	<u>6 G.W.D.F.; 9.3 lbs/gal</u>
<u>8</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>220.5</u>	<u>190</u>		<u>390</u>	<u>5 Quik GROUT; 9.3 lbs/gal</u>
<u>9</u>	<u>✓</u> <u>250</u>	<u>20</u>	<u>240.5</u>	<u>152</u>		<u>330</u>	<u>5 R.F.; 9.3 lbs/gal</u>
<u>10</u>	<u>✓</u> <u>300</u>	<u>23.5</u>	<u>264</u>	<u>107</u>		<u>330</u>	<u>6 R.F.; 9.3 lbs/gal</u>
Notes: Annular volume cubic feet per linear foot = ( D <sup>2</sup> - d <sup>2</sup> ) x 0.005454 ALL DEPTHS ARE FEET BELOW LAND SURFACE 50 lbs bag of bentonite chips = 0.7 Ft <sup>3</sup> Density of sand and gravel = 100 lbs/Ft <sup>3</sup> Full super sack (sk.) of filter pack is 30 Ft <sup>3</sup>							
Total Bags of Cement: <u>30</u> Total Bags of Bentonite Gel: <u>1</u> Total Bags of Bentonite Chips: <u>10 bags, before cement</u> Total Bags of Transition Sand: _____ Total Super Sacks of Filter Pack: _____							



Page 2 of 2[illegible]

Project Name.: <i>Exvelsior</i>	Project No.: <i>38681</i>
Well Site: <i>NSH-023</i>	Date: <i>11/15/15</i>
Location:	Staff: <i>D. Hockle</i>

**Type of Connections:** ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.19	20.19	8" casing					
2	✓	20.11	40.3						
3	✓	20.12	60.42						
4	✓	20.12	80.54						
5	✓	20.13	100.67						
6	✓	20.13	120.8						
7	✓	20.14	140.94						
8	✓	20.13	161.07						
9	✓	20.13	181.2						
10	✓	20.13	201.33						
11	✓	20.19	221.52						
12	✓	20.12	241.64						
13	✓	20.19	261.83						
14	✓	20.15	281.98						
15	✓	20.13	302.11						
16	✓	20.13	322.24						
17	✓	20.12	342.36						
18	✓	20.13	362.49						
19	✓	20.13	382.62						
20	✓	20.14	402.76						
21	✓	20.12	422.88						
22	✓	20.13	443.01						
23	✓	20.12	463.13						
24	✓	20.13	483.26						
25	✓	20.12	503.38						
26	✓	20.10	523.48						
27	✓	20.11	543.59						
28	✓	20.14	563.73						
29	✓	20.13	583.86						
30	✓	20.14	604.00						
31	✓	20.14	624.14						
32	✓	20.13	644.27						
33	✓	20.12	664.39	✓					
	✓	-16.71	647.68	cut off					
		-2.30	645.38	stickup					

# ANNULAR MATERIAL RECORD

Project: EX-6501  
Well ID: NSH-024

Project No.: 38681

Staff: D. Hunte, C. GARDNER

Dates: 1/19/15, 2-8-15

Total Well/Casing Depth: 625.34 feet  
Well/Casing Diameter [d]: 8.625 inches

Length of Rathole: - feet  
Rat Hole Volume per foot: - Ft<sup>3</sup>/Lin. Ft

Borehole Diameter [D]: 13 inches  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft

Borehole Diameter [D]: 13 inches  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft  
Annular Volume per Linear Foot: (interval) 0-625.34 Ft<sup>3</sup>/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 1645	1586.9	15	544.562	-	600	10 bags cement, 0.5 bag gal, 2 bags CaCl <sub>2</sub> 14.6 lbs/gal
2	✓ 500	406.7	55.915	544.562	440	500	2 batches of 158 gal / 5 bags grant
3	✓ 11	11	95.142	440	440	440	2 batches of 158 gal / 5 bags grant
4	✓ 4750	104.60	135.155	440	380.400	380.400	3 batches, grant hit + frame
5	✓		246	300	320.280		
6	✓ 500	40	55	528.8		500	2 batches of 158 gal / 5 bags grant hit + frame
7	✓ 500	40	95	458.6		440	" hit + frame
8	✓ 750	60	155	353.3		300	3 batches of 158 gal / 5 bags grant, grant hit + frame
9	✓ 750	60	215	248		300	3 batches, hit + frame
10	✓ 250	20	235	213		220	1 batch, hit + frame

Notes: Annular volume cubic feet per linear foot = (D<sup>2</sup> - d<sup>2</sup>) x 0.005454  
ALL DEPTHS ARE FEET BELOW LAND SURFACE  
50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>  
Density of sand and gravel = 100 lbs/Ft<sup>3</sup>  
Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement: 35-35  
Total Bags of Bentonite Gel: 0.5  
Total Bags of Bentonite Chips: 10 bags hole plug before cement  
Total Bags of Transition Sand: NONE  
Total Super Sacks of Filter Pack: NONE

1 gal = 0.133 ft<sup>3</sup>

total bags ann. grant = 75  
2 bags CaCl<sub>2</sub> in cement



## Page 2 of 2

Notes: 1 batch = 5 solbags graft & 150 gnl  $H_2O$

# PIPE TALLY for 8" casing

Project Name.: <u>Excelstar</u>	Project No.: <u>38681</u>
Well Site: <u>ASH-024</u>	Date: <u>11/9/15</u>
Location:	Staff: <u>P. Kioser</u>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.12	20.12	8" casing	32		16.71	640.77	
2	✓	20.11	40.23				-12.5	628.27	cut off
3	✓	20.14	60.37				-1.9	626.37	cut off
4	✓	20.13	80.50						
5	✓	20.14	100.64						
6	✓	20.14	120.78						
7	✓	20.13	140.91						
8	✓	20.12	161.03						
9	✓	20.14	181.17						
10	✓	20.11	201.28						
11	✓	20.12	221.40						
12	✓	20.14	241.54						
13	✓	20.12	261.66						
14	✓	20.14	281.80						
15	✓	20.12	301.92						
16	✓	20.13	322.05						
17	✓	20.14	342.19						
18	✓	20.13	362.32						
19	✓	20.14	382.46						
20	✓	20.12	402.58						
21	✓	20.14	422.72						
22	✓	20.13	442.85						
23	✓	20.14	462.99						
24	✓	20.14	483.13						
25	✓	20.14	503.27						
26	✓	20.12	523.39						
27	✓	20.14	543.53						
28	✓	20.13	563.66						
29	✓	20.12	583.78						
30	✓	20.13	603.91						
31	✓	20.15	624.06						
32	✓	20.13	644.19						
					SUMMARY OF TALLY				
					Total length of casing/screen tallied (ft.):				
					Length of casing cut off after landing (ft.):				
					Bottom of Casing (feet, bls):				
					Stick up (ft, als):				
					Screened Interval(s) (ft.bl):				
					Total feet of screen in hole (ft.):				

Notes:

8" steel casing (8" casing on 5" c 3 33,0.  
660ft total (nominal) 2 5/8" OD; 8 1/8" ID

Surface casing stickup = 0.5 ft, asl

# ANNULAR MATERIAL RECORD

Project: 38681

Well ID: NSH-025

Project No.: 38681

Dates: 1-24-15, 1-25-15,

Staff: J. Cook, K. Ford

Total Well/Casing Depth: 1130 feet

Well/Casing Diameter [d]: 4.5" O.D. inches

Length of Rathole: 30 feet

Rat Hole Volume per foot: 0.54 Ft³/Lin. Ft

Rat Hole Volume: 222 Ft³

Rat Hole from 1590' to 1560'

Borehole Diameter [D]:

Annular Volume per Linear Foot: (interval)

10 inches	0.43 Ft³/Ft	TD ~ 1230	10 inches	0.43 Ft³/Ft	830-680
71 inches	0.55 Ft³/Ft	1230-1220	12 inches	0.67 Ft³/Ft	680-650
10 inches	0.43 Ft³/Ft	1220-845	10.5 inches	0.49 Ft³/Ft	650-100
11 inches	0.55 Ft³/Ft	845-830	11 inches	0.55 Ft³/Ft	100-Surface

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	250	3.5	3.5	1583.5	N/A	1580	5-50 LB. Bags of Hole Plug (clogged tremie); 6.5 ft rise
2	75	1.05	4.55	1581.6	1595.5	1560	1.5-50 LB Bags Hole Plug (clogged tremie; added joint to bag)
1	500	7.0	11.6	1582.5	1591	1560	10x50 LB Bags 20x40 Silica Sand, 13 ft rise (tremie bag)
2	500	7.0	18.6	1569.5	1589.5	1560	" "
3	500	7.0	25.6	1566.5	1568.5	1560	" " Tremie tag: 1586.5; wait 1 hr, 1568; wait 0.5 hr, 1568.
4	400	5.6	31.2	1558	1559.5	1540	8x50 LB Bags No 20/40 sand 10 ft (clog) rise
15					(1515)	1520	1x Super Sack 1/4" x N0.8 Tacoma Filter Pack
	3300	33	64.7	1495.9		1480	(pulled 2 joint tremie) ~ 3/4 way through sack
2	1100	11	75.2	1469.5	1475	1480	17x5 gal bucket Filter pack; ~ 26.4 ft rise

Notes: Annular volume cubic feet per linear foot = (D² - d²) x 0.005454

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft³

Density of sand and gravel = 100 lbs/Ft³

Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement: 11A

Total Bags of Bentonite Gel: 136 quargard, 14 Quik great

Total Bags of Bentonite Chips: 12

Total Bags of Transition Sand: 49

Total Super Sacks of Filter Pack:

# ANNULAR MATERIAL RECORD

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Project: 38681 Project No.: 38681 Staff: SCOOK, KFORIS

Well ID: NSR-025 Dates: 1-24-15 1-25-15 1-26-15

Super Sk. or Batch	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
3	✓ 200	2	77.2	1469.5	1469	1460	3 x 5 gal bucket Filter pack ~ S.S. Ft rize
5	✓ 400	5.6	82.8	1456	1461.2	1440	8 x 50 lb bags 20x40 sand, 13 ft rize
6	✓ 100	2	84.8	1459	1460	1450	2 x 50 lb bags of 110 20x40 sand
1	✓ 400	42.7	127.5	1360.7	NA	1420	GROUT Batch 1, 8 bags 30% solids GROUT and 300 gallons water
2	✓ 400	42.7	170.2	1261.4	NA	1340	GROUT Batch 2, 8 bags 30% solids GROUT and 300 gallons water
3	✓ 400	42.7	212.9	1165	NA	1340	GROUT Batch 3, 8 bags 30% solids GROUT and 300 gallons water
4	✓ 400	42.7	255.6	1066	NA	1260	GROUT Batch 4, 8 bags 30% solids GROUT, 300 gallons water
5	✓ 400	42.7	298.3	967	NA	1240	GROUT Batch 5, 8 bags 30% solids GROUT, 300 gallons water
6	✓ 400	42.7	341	868	NA	1240	GROUT Batch 6, 8 bags 30% solids GROUT, 300 gallons water
7	✓ 400	42.7	383.7	773	NA	1240	GROUT Batch 7, 8 bags 30% solids GROUT, 300 gallons water
8	✓ 400	42.7	426.4	676	NA	1160	GROUT Batch 8, 8 bags 30% solids GROUT, 300 gal water
9	✓ 400	42.7	469.1	578	NA	1160	GROUT Batch 9, 8 bags 30% solids GROUT, 300 gal water
10	✓ 400	42.7	511.8	511	NA	1080	GROUT Batch 10, 8 bags 30% solids GROUT, 300 gal water
11	✓ 400	42.7	554.5	424	NA	1080	GROUT Batch 11, 8 bags 30% solids GROUT, 300 gal water
12	✓ 400	42.7	597.2	337	NA	1080	GROUT Batch 12, 8 bags 30% solids GROUT, 300 gal water
13	✓ 400	42.7	639.9	250	Surface	1080	GROUT Batch 13, 8 bags 30% solids GROUT, 300 gal water
14	✓ 400	42.7	682.6	163	↓	1080	GROUT Batch 14, 8 bags 30% solids GROUT, 300 gal water
15	✓ 400	42.7	725.3	74	↓	1080	GROUT Batch 15, 8 bags 30% solids GROUT, 300 gal water
16	✓ 400	42.7	768	Surface-0	↓	1080	GROUT Batch 16, 8 bags 30% solids GROUT, 300 gal water
17	✓ 400	44.1	812.1	± 80	↓	1080	GROUT Batch 17, 8 bags 30% solids GROUT, 300 gal water

Notes: Batch 1-16 GROUT calculated mud weight is 9.0

17 & 18 use different brand GROUT.

batch 17 estimated mud weight 9.2

batch 18 estimated mud weight 9.7

11



## Page 3 of 3

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## PIPE TALLY for 4" CASING

Project Name.: <i>Excelsior</i>	Project No.: <i>38691</i>
Well Site: <i>NSH-025</i>	Date: <i>1-24-15</i>
Location: <i>Cochise County, AZ</i>	Staff: <i>Jason Cook</i>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	10.56		4" slotted screen	37	✓	20.08	734.17	4" Blank
2	✓	20.12	30.68		38	✓	20.12	754.29	
3	✓	20.07	50.75		39	✓	20.09	774.38	
4	✓	20.11	70.86		40	✓	20.10	794.48	
5	✓	20.07	90.93	4" Blank	41	✓	20.09	814.57	
6	✓	20.15	111.08		42	✓	20.11	834.68	
7	✓	20.07	131.15		43	✓	20.07	854.75	
8	✓	20.14	151.29		44	✓	20.09	874.84	
9	✓	20.23	171.52		45	✓	20.10	894.94	
10	✓	20.08	191.60		46	✓	20.08	915.02	
11	✓	20.16	211.76		47	✓	20.08	935.10	
12	✓	20.06	231.82		48	✓	20.05	955.15	
13	✓	20.07	251.89		49	✓	20.11	975.26	
14	✓	20.12	272.01		50	✓	20.06	995.32	
15	✓	20.08	292.07		51	✓	20.07	1015.39	
16	✓	20.14	312.21		52	✓	20.07	1035.46	
17	✓	20.08	332.29		53	✓	20.04	1055.50	
18	✓	20.18	352.47		54	✓	20.11	1075.61	
19	✓	20.13	372.6		55	✓	20.11	1095.72	
20	✓	20.07	392.67		56	✓	20.10	1115.82	
21	✓	20.06	412.73		57	✓	20.08	1135.90	
22	✓	20.10	432.83		58	✓	20.09	1155.99	
23	✓	20.08	452.91		59	✓	20.05	1176.04	
24	✓	20.08	472.99		60	✓	20.09	1196.13	
25	✓	20.10	493.09		61	✓	20.06	1216.19	
26	✓	20.08	513.17		62	✓	20.06	1236.25	
27	✓	20.07	533.24		63	✓	20.15	1256.40	
28	✓	20.09	553.33		64	✓	20.16	1276.56	
29	✓	20.08	573.41		65	✓	20.14	1296.70	
30	✓	20.12	593.53		66	✓	20.07	1316.77	
31	✓	20.11	613.64		67	✓	20.09	1336.86	
32	✓	20.09	633.73		68	✓	20.09	1356.95	
33	✓	20.12	653.85		69	✓	20.04	1376.99	
34	✓	20.08	673.93		70	✓	20.07	1397.06	
		20.09	694.02		71	✓	20.05	1417.11	
		20.07	714.09		72	✓	20.08	1437.19	

PIPE TALLY for 4" CASING

Project Name.: EXCELSIOR	Project No.: 38681
Well Site: NSH-025	Date: 1-24-15
Location: NSH-DP	Staff: J Cook, K Ford

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

[illegible]

Notes:

6.71 ft Stick up on last joint Puts top of screen at 1480

# ANNULAR MATERIAL RECORD

Page 2 of 2

Project: Excelsior

Project No.: 38681

Staff: P. Kuper

Well ID: 154-020

Dates: 1-25-15, 3-17-15

Total Well/Casing Depth: 625 feet

Length of Rathole: 1 feet

Rat Hole Volume: — Ft<sup>3</sup>

Well/Casing Diameter [d]: 8.625 inches

Rat Hole Volume per foot: — Ft<sup>3</sup>/Lin. Ft

Borehole Diameter [D]: 13 inches

Borehole Diameter [D]: — inches

Annular Volume per Linear Foot: (interval)

0.52 Ft<sup>3</sup>/Ft

625-20

Ft<sup>3</sup>/Ft

0.59 Ft<sup>3</sup>/Ft

20-0

Ft<sup>3</sup>/Ft

— Ft<sup>3</sup>/Ft

— inches

Ft<sup>3</sup>/Ft

— Ft<sup>3</sup>/Ft

— inches

Ft<sup>3</sup>/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 500	7	7	612		N/A	10 x 50 lbs hole plug
1	✓ 1650	30	37	554		600	32 x 50 lbs cement; 1 bag; 2 each side
1	✓ 300	19	56	547		580	6 x 50 lbs Quik Grant; 9.5 lbs/gal
2	✓ 300	23.5	79.5	502		540	6 x 50 lbs Quik Grant; 9.3 lbs/gal
3	✓ 300	23.5	103	457		540	6 x 50 lbs Quik Grant; 9.3 lbs/gal
4	✓ 300	21	124	417		440	6 x 50 lbs Quik Grant; 9.4 lbs/gal
5	✓ 300	23.5	147.5	372		440	6 x 50 lbs Quik Grant; 9.3 lbs/gal
6	✓ 300	23.5	171	327		440	6 x 50 lbs Quik Grant; 9.3 lbs/gal
7	✓ 300	26	197	277		340	6 x 50 lbs Quik Grant; 9.2 lbs/gal
8	✓	23.5	220.5	232		340	6 x 50 lbs Quik Grant; 9.3 lbs/gal
9	✓ 300	23.5	244	187		340	10 x 50 lbs Quik Grant; 9.3 lbs/gal

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

Total Bags of Cement: 32

ALL DEPTHS ARE FEET BELOW LAND SURFACE

Total Bags of Bentonite Gel: 1

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>

Total Bags of Bentonite Chips: 10

Density of sand and gravel = 100 lbs/Ft<sup>3</sup>

Total Bags of Transition Sand: Quik Grant: 90

Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Super Sacks of Filter Pack: —



# ANNUAL MATERIAL RECORD

[illegible]

PIPE TALLY for *8 5/8 steel casing*

Project Name.: <i>Exxon</i>	Project No.: <i>38681</i>
Well Site: <i>NSH-026</i>	Date: <i>1/24/15</i>
Location:	Staff: <i>P. Kruger</i>

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	20.12	20.12	8" casing				627.19	
2	✓	20.09	40.21				-1.53	cut off	
3	✓	20.14	60.35					625.66	
4	✓	20.13	80.48						
5	✓	20.12	100.6						
6	✓	20.11	120.71						
7	✓	20.14	140.85						
8	✓	20.14	160.99						
9	✓	20.12	181.11						
10	✓	20.12	201.23						
11	✓	20.12	221.35						
12	✓	20.12	241.47						
13	✓	20.13	261.6						
14	✓	20.12	281.72						
15	✓	20.12	301.84						
16	✓	20.13	321.97						
17	✓	20.12	342.09						
18	✓	20.12	362.21						
19	✓	20.12	382.33						
20	✓	20.12	402.45						
21	✓	20.13	422.58						
22	✓	20.13	442.71						
23	✓	20.14	462.85						
24	✓	20.12	482.97						
25	✓	20.12	503.09						
26	✓	20.12	523.21						
27	✓	20.12	543.33						
28	✓	20.11	563.44						
29	✓	20.13	583.57						
30	✓	20.13	603.7						
31	✓	20.11	623.18						
32		12.52							
		-21.13	cut off	+ 21.13 reattached					
32	✓	20.13	643.31						
		-16.12	cut off						
			627.19						

33 total on site

# ANNULAR MATERIAL RECORD

Page 1 of 3

Project: EXCELSIOR Project No.: 38681 Staff: K Ford, J Cook, C Price.  
Well ID: NSH-027 Dates: 1-29-15 to 2-1-15

Total Well/Casing Depth: 1010 feet Length of Rathole: — feet Rat Hole Volume: — Ft<sup>3</sup>  
Well/Casing Diameter [d]: 6.75 inches Rat Hole Volume per foot: — Ft<sup>3</sup>/Lin. Ft

Borehole Diameter [D]: Annular Volume per Linear Foot: (interval) Borehole Diameter [D]: Annular Volume per Linear Foot: (interval)  
13 inches 0.67 Ft<sup>3</sup>/Ft 13 inches 0.67 Ft<sup>3</sup>/Ft 420 - 0  
12.75 inches 0.64 Ft<sup>3</sup>/Ft — inches — Ft<sup>3</sup>/Ft —  
13 inches 0.67 Ft<sup>3</sup>/Ft — inches — Ft<sup>3</sup>/Ft —  
12.5 inches 0.60 Ft<sup>3</sup>/Ft — inches — Ft<sup>3</sup>/Ft —

Super Sk. or Batch No.	✓	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	3000	30		978	797.5	960	Super Sack of 1/4" x NO8 Tacoma Filter Pack
2	✓	1500	15	45	955	~950	940	Partial Super sack 1/4" x NO8 Tacoma Filter Pack
3	✓	3000	30	75	903	~903	900	Super Sack of 1/4" x NO8 Tacoma Filter Pack
4	✓	3000	30	105	856	857	880-880	Super Sack of 1/4" x NO8 Tacoma Filter Pack
5	✓	500	5	110	850	850	840	10 5 gal buckets of 1/4" x NO8 Tacoma, about 3/4 full
1	✓	400	4	114	844	~844	840	8 x 50 lb bags of No 20x40 sand.
2	✓	250	2.5	116.5	845	843	840	5 x 50 lb bags of No 20x40 sand.
3	✓	250	2.5	119	839	840	830	5 x 50 lb bags of No 20x40 sand
1	✓	250	33.5	152.5	778.	-	820	Grout Batch 1, 5 bags of cement, ~225 gallons of water
2	✓	300	40.3	142.8	717	-	820	Grout Batch 2, 6 bags of cement, ~270 gallons of water
3	✓	300	40.3	233.1	651	-	780	Grout Batch 3, 6 bags of cement, ~270 gallons of water

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>

Density of sand and gravel = 100 lbs/Ft<sup>3</sup>

Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement: NA

Total Bags of Bentonite Gel: 117

Total Bags of Bentonite Chips: 5

Total Bags of Transition Sand: 18

Total Super Sacks of Filter Pack: ~12

# ANNULAR MATERIAL RECORD

Page 2 of 3

Project: <u>EXCELSIOR</u>		Project No.: <u>38681</u>		Staff: <u>K Ford, J Cook, C Price,</u>	
Well ID: <u>NSH-027</u>		Dates: <u>1-24-15 to 2-1-15</u>			

Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
4	✓	300	40.3	273.3	583	-	780	Groat Batch 4, 6 bags of groat, ~270 gallons of water
5	✓	300	40.3	313.7	516	-	700	Groat Batch 5, 6 bags of groat, ~270 gallons of water
6	✓	300	40.3	354	450	-	700	Groat Batch 6, 6 bags of groat, ~270 gallons of water
7	✓	300	40.3	394.3	386	-	640	Groat Batch 7, 6 bags of groat, ~270 gallons of water
8	✓	300	40.3	434.6	326	-	640	Groat Batch 8, 6 bags of groat, ~270 gallons of water
9	✓	300	40.3	474.9	266	-	580	Groat Batch 9, 6 bags of groat, ~270 gallons of water
10	✓	300	40.3	515.2	206	-	460	Groat Batch 10, 6 bags of groat, ~270 gallons of water
11	✓	300	40.3	555.5	145	-	460	Groat Batch 11, 6 bags of groat, ~270 gallons of water
12	✓	300	40.3	595.8	85	-	400	Groat Batch 12, 6 bags of groat, ~270 gallons of water
13	✓	300	40.3	636.1	25	-	340	Groat Batch 13, 6 bags of groat, ~270 gallons of water
14	✓	300	40.3	676.4	+35	-	200	Groat Batch 14, 6 bags of groat, ~270 gallons of water
15	✓	300	40.3	716.7	+95	-	200	Groat Batch 15, 6 bags of groat, ~270 gallons of water
16	✓	300	40.3	757	+155	-	200	Groat Batch 16, 6 bags of groat, ~270 gallons of water
17	✓	30	40.3	797.3	+215	-	200	Groat Batch 17, 6 bags of groat, ~270 gallons of water
18	✓	400	40.4	837.7	+265	-	Surface	Groat Batch 18, 8 bags of groat, ~260 gallons of water
19	✓	400	40.4	878.1	+325	-	Surface	Groat Batch 19, 8 bags of groat, ~260 gallons of water
6	✓	175	3.5	881.6	+330	-	NA	5 x 50 bags of Hole Plug
7	✓	1500	15	896.6	+353	-	NA	.5 Super sack 1/4" x 108 Tacoma Filter Pack
8	✓	3000	30	926.6	+348	-	NA	Full Super sack 1/4" x 108 Tacoma Filter Pack
9	✓	3000	30	956.6	+443	-	NA	Full Super sack 1/4" x 108 Tacoma Filter Pack
10	✓	3000	30	986.6	+488	~130	NA	Full Super sack 1/4" x 108 Tacoma Filter Pack

Notes:



Notes:

## PIPE TALLY 6" CASING

Project Name.: EXCELSIOR	Project No.: 38681
Well No.: NSH-027	Date: 1-29-15
Location: NSH-BG	Pipe Tally for: 6" CASING
Total Depth:	Geologist:

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	4.25		6" Screen.	31	✓	20.14	607.20	6" blank
2	✓	20.13	24.38		32	✓	20.08	627.28	
3	✓	20.12	44.50		33	✓	20.10	647.38	
4	✓	20.13	64.63		34	✓	20.08	667.46	
5	✓	20.11	84.74		35	✓	20.11	687.57	
6	✓	20.06	104.80		36	✓	20.13	707.70	
7	✓	20.10	124.90		37	✓	20.08	727.78	
8	✓	20.10	145.00		38	✓	20.08	747.86	
9	✓	20.10	165.10	6" Blank	39	✓	20.07	767.93	
10	✓	20.09	185.19		40	✓	20.06	787.99	
11	✓	20.13	205.32		41	✓	20.10	808.09	
12	✓	20.09	225.41		42	✓	20.09	828.18	
13	✓	20.08	245.49		43	✓	20.08	848.26	
14	✓	20.09	265.58		44	✓	20.07	868.33	
15	✓	20.09	285.67		45	✓	20.08	888.41	
16	✓	20.10	305.77		46	✓	20.12	908.53	
17	✓	20.01	325.78		47	✓	20.12	928.65	
18	✓	20.13	345.91		48	✓	20.08	948.73	
19	✓	20.08	365.99		49	✓	20.15	968.88	
20	✓	20.10	386.09		50	✓	20.10	988.98	
21	✓	20.11	406.20		51	✓	20.09	1009.07	
22	✓	20.10	426.30		52	✓	4.14	1013.24	
23	✓	20.09	446.39		SUMMARY OF TALLY Total Length tallied: 1013.24 Casing Stick-Up: 1.01 Length of Casing Cut-Off: 2.23 Bottom of Well: 1010.00 Screened Interval: 865 - 1010 Total Screen in Hole: 145 ft				
24	✓	20.12	466.51						
25	✓	20.09	486.60						
26	✓	20.09	506.69						
27	✓	20.10	526.79						
28	✓	20.09	546.88						
29	✓	20.09	566.97						
30	✓	20.09	587.06						

Notes:

2 centralizers used 1 in 65' and one at top of screen.

Casing is 6 5/8" OD. low Carbon Steel, 0.250" wall thickness

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681</u>		Staff: <u>J Cook</u>	
Well ID: <u>USH-028</u>		Dates: <u>1-28-15</u>			
Total Well/Casing Depth: <u>543.6</u> feet		Length of Rathole: <u>0</u> feet		Rat Hole Volume: <u>NA</u> Ft³	
Well/Casing Diameter [d]: <u>8 5/8</u> inches		Rat Hole Volume per foot: <u>0.92</u> Ft³/Lin. Ft		<u>Before casing Install.</u>	
Borehole Diameter [D]: <u>13</u> inches		Annular Volume per Linear Foot: (interval)		Annular Volume per Linear Foot: (interval)	
_____ inches		_____ Ft³/Ft		_____ Ft³/Ft	
_____ inches		_____ Ft³/Ft		_____ Ft³/Ft	
_____ inches		_____ Ft³/Ft		_____ Ft³/Ft	
_____ inches		_____ Ft³/Ft		_____ Ft³/Ft	

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 200	2.8	2.8	541	NA	520	4x50 Lb. Hole Plug. Installed with casing off bottom
1	✓ 1650	35.4	38.2	473	-	520	32x47 Lb Portland 1x50 Lb bag gel 2x50 Lb each, ~140 gallons water
1	✓ 300	22.4	61.1	429	-	460	Grout Batch 1, 6x50 Lb bags QuickGrout, ~140 gallons water
2	✓ 300	22.4	84	385	-	400	Grout Batch 2, 6x50 Lb bags QuickGrout, ~140 gallons water
3	✓ 600	45.8	129.8	297	-	400	Grout Batch 3, 12x50 Lb bags QuickGrout, ~280 gallons water
4	✓ 600	45.8	175.6	209	-	360	Grout Batch 4, 12x50 Lb bags QuickGrout, ~280 gallons water
5	✓ 600	45.8	221.4	121	-	260	Grout Batch 5, 12x50 Lb bags QuickGrout, ~280 gallons water
6	✓ 600	45.8	267.2	33	-	260	Grout Batch 6, 12x50 Lb bags QuickGrout, ~280 gallons water
7	✓ 600	45.8	313	+57	-	160	Grout Batch 7, 12x50 Lb bags QuickGrout, ~280 gallons water
8	✓ 600	45.8	358.8	+143	-	160	Grout Batch 8, 12x50 Lb bags QuickGrout, ~280 gallons water
4	✓ 600	45.8	404.6	+231	✓	out	Grout Batch 9, 12x50 Lb bags QuickGrout, ~280 gallons water

Notes:	Annular volume cubic feet per linear foot = $(D^2 - d^2) \times 0.005454$
ALL DEPTHS ARE FEET BELOW LAND SURFACE	
50 lbs bag of bentonite chips = 0.7 Ft³	
Density of sand and gravel = 100 lbs/Ft³	
Full super sack (sk.) of filter pack is 30 Ft³	
Total Bags of Cement:	<u>32</u>
Total Bags of Bentonite Gel:	<u>121</u>
Total Bags of Bentonite Chips:	<u>4</u>
Total Bags of Transition Sand:	
Total Super Sacks of Filter Pack:	<u>7.5</u>



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Dates: 1-28-15, 1-31-15

Notes: GAWIT DROPPED FROM SURFAC ON 1-28-15 TO ~~2887~~ ON 1-31-15  
ADDED JACNA TO SURFAC



PIPE TALLY for 8" CASING

Project Name.: EXCELSIOR	Project No.: 38681
Well Site: NSH-028	Date: 1-28-15
Location: NSH-BH	Staff: K FORD, J Cook

Type of Connections: ☒ Welded ☐ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length $\Sigma$ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length $\Sigma$ (ft)	Pipe Type
1	✓	19.94	19.94	8" casing					
2	✓	19.90	39.84						
3	✓	19.90	59.74						
4	✓	19.95	79.69						
5	✓	19.88	99.57						
6	✓	19.90	119.47						
7	✓	19.81	139.28						
8	✓	19.81	159.09						
9	✓	19.80	178.89						
10	✓	19.94	198.83						
11	✓	20.08	218.91						
12	✓	19.84	238.75						
13	✓	19.83	258.58						
14	✓	19.96	278.54						
15	✓	19.75	298.29						
16	✓	19.76	318.05						
17	✓	19.38	337.43						
18	✓	20.09	357.52						
19	✓	20.00	377.52						
20	✓	19.98	397.5						
21	✓	19.76	417.26						
22	✓	20.07	437.33						
23	✓	19.82	457.15						
24	✓	19.84	476.99						
25	✓	19.96	496.95						
26	✓	20.06	517.01						
27	✓	19.78	536.79						
28	✓	12.53	549.32	cut off					
			- 4.81	4.81 Ft ; 0.85 Ft stickup					
			- 0.85						
			<u>543.66</u>	Total length of casing in borehole					

1-28-15: 30 joints of 8" brought to site  
(laid out in clearing on hill)

# ANNULAR MATERIAL RECORD

Project: EXCAVATION  
Well ID: NSH-029

Project No.: 38681  
Dates: 1-29-15

Staff: C. GARDNER

Total Well/Casing Depth: 709 feet  
Well/Casing Diameter [d]: 2.375 inches  
Length of Rathole: 1 feet  
Rat Hole Volume per foot: 0.23 Ft<sup>3</sup>/Lin. Ft  
Rat Hole Volume: 0.2 Ft<sup>3</sup>

Borehole Diameter [D]: 6 1/2 inches  
Annular Volume per Linear Foot: (interval)  
19-709 Ft<sup>3</sup>/Ft  
0-19 Ft<sup>3</sup>/Ft  
0-7 Ft<sup>3</sup>/Ft  
         Ft<sup>3</sup>/Ft  
Borehole Diameter [D]:          inches  
Annular Volume per Linear Foot: (interval)  
         Ft<sup>3</sup>/Ft  
         Ft<sup>3</sup>/Ft  
         Ft<sup>3</sup>/Ft  
         Ft<sup>3</sup>/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft <sup>3</sup> )	Total Vol. Installed (ft <sup>3</sup> )	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓ 1000	10.0	10.0	660	655	661	1/4-INCH x No. 8 TACNA FILTER PACK
2	✓ 3000	15.0	25.0	580	575	578	↓
1	✓ -	4.2	29.2	554	-	0	BENTONITE CHIPS (6 x 50 lb. BAGS)
1	✓ 10,360	103.6	132.8	360	-	0	3/8-INCH PEA GRAVEL (~1/3 OF 15.54 TONS)
2	✓ 1500	15.0	147.8	-39	100	0	1/4-INCH x No. 8 TACNA GRAVEL
3	✓ 1000	10.0	157.8	-89	-	0	3/8-INCH PEA GRAVEL (~1/2 TON)
4	✓ 1000	10.0	167.8	-137	10	0	↓
5	✓ 200	2.0	169.8	0.5	0	0	

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup>

Density of sand and gravel = 100 lbs/Ft<sup>3</sup>

Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement: 0  
Total Bags of Bentonite Gel: 0  
Total Bags of Bentonite Chips: 6  
Total Bags of Transition Sand: 0  
Total Super Sacks of Filter Pack: ~1 SK (~25 Ft<sup>3</sup>)

## PIPE TALLY for

CASING &amp; SCREEN

Project Name.: <u>Excelsior</u>	Project No.: <u>38681</u>
Well Site: <u>NSH-029</u>	Date: <u>1-29-15</u>
Location: <u>NSH-029</u>	Staff: <u>C. Price, C. GARDNER</u>

Type of Connections: ☐ Welded ☒ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	21.08	21.08	slotted	33	✓	21.10	696.38	BLANK
2	✓	21.08	42.16	slotted	34	✓	21.10	717.48	↓
3	✓	21.08	63.24	slotted	35	OUT			
4	✓	21.13	84.37	slotted					
5	✓	21.16	105.53	slotted					
6	✓	21.10	126.63	blank					
7	✓	21.09	147.72	blank					
8	✓	21.13	168.85						
9	✓	21.08	189.93						
10	✓	21.10	211.03						
11	✓	21.12	232.15						
12	✓	21.08	253.23						
13	✓	21.13	274.36						
14	✓	21.12	295.48						
15	✓	21.06	316.54						
16	✓	21.09	337.63						
17	✓	21.11	358.74						
18	✓	21.07	379.81						
19	✓	21.12	400.93						
20	✓	21.11	422.04						
21	✓	21.12	443.16						
22	✓	21.10	464.26						
23	✓	21.10	485.36						
24	✓	21.10	506.46						
25	✓	21.10	527.56						
26	✓	21.10	548.66						
27	✓	21.12	569.78						
28	✓	21.10	590.88						
29	✓	21.10	611.98						
30	✓	21.10	633.08						
31	✓	21.10	654.18						
32	✓	21.10	675.28	↓					
SUMMARY OF TALLY									
Total length of casing/screen tallied (ft.):							717.5		
Length of casing cut off after landing (ft.):							6.1		
Bottom of Casing (feet, bls):							709.4		
Stick up (ft, als):							2.0		
Screened Interval(s) (ft. bls):							604-709.4		
Total feet of screen in hole (ft.):							105.5		

## Notes:

30 2 3/8" OD LCS SCH 40 BLACK PIPE, ASTM A-53  
 5 2 3/8" OD slotted LCS SCH 40 BLACK PIPE ASTM A-53  
 1/8- INCH WIDE SLOTS MADE WITH PLASMA CUTTER

WITH 34 STS, TAGGED BOTTOM w/ 7.1' STICKUP, TD BHC 710.38,  
 NO FILL.

# ANNULAR MATERIAL RECORD

Project : Excelsior
Well ID: N5H-030

Project No.: 38681
Staff: C Price

Dates: 2-3-15

Total Well/Casing Depth: 705.5 feet
Well/Casing Diameter [d]: 2.375 inches

Length of Rathole: 34.5 feet
Rat Hole Volume per foot: 0.20 Ft³/Lin. Ft

Rat Hole Volume: 6.77 Ft³

Borehole Diameter [D]: 6 inches
Annular Volume per Linear Foot: 460-740

6 1/2 inches
0.20 Ft³/Ft

6.7 inches
0.20 Ft³/Ft

inches
       Ft³/Ft

Borehole Diameter [D]:        inches
Annular Volume per Linear Foot:        Ft³/Ft

inches
       Ft³/Ft

inches
       Ft³/Ft

inches
       Ft³/Ft

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$ 
ALL DEPTHS ARE FEET BELOW LAND SURFACE
50 lbs bag of bentonite chips = 0.7 Ft³
Density of sand and gravel = 100 lbs/Ft³
Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement:       
Total Bags of Bentonite Gel:       
Total Bags of Bentonite Chips: 6
Total Bags of Transition Sand:       
Total Super Sacks of Filter Pack: 1



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PIPE TALLY for CASING & SCREEN

Project Name.: <u>Excelsior</u>	Project No.: <u>38681</u>
Well Site: <u>NSH-030</u>	Date: <u>2-3-15</u>
Location: <u>NSH-ADR</u>	Staff: <u>L Price</u>

Type of Connections: ☐ Welded ☒ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1	✓	21.1	21.1	screen w/ cap	33	✓	21.1	696.3	Blank
2	✓	21.1	42.2	screen	34	✓	21.1	717.4	
3	✓	21.1	63.3	screen					
4	✓	21.1	84.4	screen					
5	✓	21.1	105.5	screen					
6	✓	21.1	126.6	Blank					
7	✓	21.1	147.7	Blank					
8	✓	21.1	168.8						
9	✓	21.1	189.9						
10	✓	21.1	211.0						
11	✓	21.1	232.1						
12	✓	21.1	253.2						
13	✓	21.1	274.3						
14	✓	21.1	295.4						
15	✓	21.1	316.5						
16	✓	21.1	337.6						
17	✓	21.1	358.7						
18	✓	21.1	379.8						
19	✓	21.1	400.9						
20	✓	21.1	422.0						
21	✓	21.1	443.1						
22	✓	21.1	464.2						
23	✓	21.1	485.3						
24	✓	21.1	506.4						
25	✓	21.1	527.5						
26	✓	21.1	548.6						
27	✓	21.1	569.7						
28	✓	21.1	590.8						
29	✓	21.1	611.9						
30	✓	21.1	633.0						
31	✓	21.1	654.1						
32	✓	21.1	675.2						

## SUMMARY OF TALLY

Total length of casing/screen tallied (ft.): 717.4  
 Length of casing cut off after landing (ft.): 1199.9  
 Bottom of Casing (feet, bls): 705.5  
 Stick up (ft, als): 1142.0  
 Screened Interval(s) (ft. bls): 705.5 - 600  
 Total feet of screen in hole (ft.): 105.5

## Notes:

5 screened - ASTM A53 SCH 40 Black Pipe 1/8 wide slots  
 29 blank - ASTM A53 SCH 40 Black Pipe

## Page 1 of 3

Staff: GP, CP

Rat Hole Volume: 2.14 Ft<sup>3</sup>

Annual Volume per Linear Foot: (interval)

\_\_\_\_\_  $F^3/Ft$  \_\_\_\_\_

\_\_\_\_\_  $F^3/Ft$  \_\_\_\_\_

\_\_\_\_\_  $F^3/Ft$  \_\_\_\_\_

\_\_\_\_\_  $F^3/Ft$  \_\_\_\_\_

Super Sk. or Batch No.	✓	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	✓	2000	2.6	2.6	670	700	695	7/8" of 1 t-arch super sacks
1	✓	—	2.8	28.8	683	—	670	4 bags of bentonite chips
1	✓	—	2.01	30.81	670	—	670	3-9416 Portland cement, 12.6 bl/gal
2	✓	—	2.01	32.82	658	—	~650	3..
3	✓	—	2.01	34.83	646	—	650	
4	✓	—	2.01	36.84	633	—	650	
5	✓	—	2.01	38.85	620	—	650	
6	✓	—	2.01	40.86	608	—	650	
7	✓	—	2.01	42.87	595	—	567	
8	✓	—	2.01	44.88	583	—	567	
9	✓	—	2.01	46.89	570	—	567	

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft<sup>3</sup> ~ 2 SX

Density of sand and gravel = 100 lbs/ft<sup>3</sup>Full super sack (sk.) of filter pack is 30 Ft<sup>3</sup>

Total Bags of Cement:

Total Bags of Bentonite Gel:

Total Bags of Bentonite Chips:

Total Bags of Transition Sand:

Total Super Sacks of Filter Pack:

# ANNULAR MATERIAL RECORD

Project: \_\_\_\_\_

Project No.: 38681

Staff: CHAD PRICK, GPF

Well ID: \_\_\_\_\_

Dates: 7/5 - 2/6/2015

Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
10	✓		2.0	48.4	558	—	567	3 94 lb Portland cement
11			2.0	50.9	546	—	567	
12			7.0	57.9	504	—	483	switch to 1 SX
13			7	64.9	462	—	483	2 SX Bent
14			3.5	68.4	441	—	483	1 sack Bent + 24 gal H <sub>2</sub> O
15			3.5	71.9	420	—	483	1 SX "
16			3.5	75.4	399	—	483	1 SX "
17			3.5	78.9	378	—	483	1 SX "
18			3.5	82.4	357	—	483	1 SX "
19			3.5	85.9	336	—	483	1 SX "
20			3.5	89.4	315	—	483	1 SX "
21			3.5	92.9	294	—	483	1 SX "
22			3.5	96.4	273	—	483	1 SX "
23			3.5	99.9	252	—	483	1 SX 50# GROUT W/ 24 gal H <sub>2</sub> O
24			3.5	103.4	231	—	483	1 SX "
25			3.5	106.9	210	—	483	1 SX "
26			3.5	110.4	189	—	483	1 SX "
27			3.5	113.9	168	—	483	1 SX "
28			3.5	117.4	147	—	483	1 SX "
29			3.5	120.9	126	—	483	1 SX "
30			3.5	124.4	105	—	483	1 SX "

Notes:

744

458  
 416  
 349  
 353  
 311  
 269  
 227  
 4 wac



Page 3 of 3

592

SHD Be 2 Left

## PIPE TALLY for CASING &amp; SCREEN

Project Name.: GUNNISON	Project No.: 3808
Well Site: NSH-03	Date: 2/5/15
Location: N. of FREEMAN	Staff: BT

Type of Connections: ☐ Welded ☒ T+C ☐ Flush Thread ☐ Other 2 3/8" OD / 0.2'

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1		21.15	21.15	Blank	<del>27</del>				
2		20.95	42.10		<del>38</del>				
3		21.00	63.1		<del>39</del>				
4		21.11	84.21		<del>40</del>				
5		21.17	105.38		<del>41</del>				
6		21.20	126.58		1		21.02		Perf
7		21.15	147.71		2		21.15		
8		21.00	168.71		3		21.10		
9		20.90	189.61		4		21.12	84.35	
10		21.00	210.61						
11		21.02	231.63						
12		21.18	252.81						
13		21.10	273.91						
14		21.00	294.91						
15		21.12	316.03						
16		21.10	337.13						
17		21.09	358.22						
18		20.95	379.17						
19		21.05	400.22						
20		21.11	421.33						
21		21.10	442.43						
22		21.00	463.43						
23		21.12	484.55						
24		21.09	505.64						
25		21.08	526.72						
26		21.10	547.82						
27		20.95	568.77						
28		21.13	589.90						
29		21.09	610.99						
30		21.10	632.05						
31		21.08	653.17						
32		21.13	674.30						
33		20.90	695.20						
34		20.98	716.18						
35		21.12	737.30						

721 - 805

722 - 806

SCREEN 720 - 804

2.0 ft stickup

WASH OFF H<sub>2</sub>O w/ stickup.

# ANNULAR MATERIAL RECORD

Project: EX-1610101  
Well ID: NSH-032

Project No.: 38601  
Dates: 2/9/15 - 2-10-15

Staff: SPF, CP

Total Well/Casing Depth: 804 feet  
Well/Casing Diameter [d]: 23/8 inches

Length of Rathole: 16 feet  
Rat Hole Volume per foot: 0.19625 Ft³/Lin. Ft

Rat Hole Volume: 3.14 Ft³

Borehole Diameter [D]: Annular Volume per Linear Foot: (interval)  
6 inches 0.16485 Ft³/Ft 700-804 ~17 Ft³  
6 inches 0.16485 Ft³/Ft 690-700 ~45X  
6 inches 0.16485 Ft³/Ft 0-690 -annul grout 113³  
inches \_\_\_\_\_ Ft³/Ft

Borehole Diameter [D]: \_\_\_\_\_ inches  
Annular Volume per Linear Foot: (interval)  
\_\_\_\_\_ Ft³/Ft  
\_\_\_\_\_ Ft³/Ft  
\_\_\_\_\_ Ft³/Ft  
\_\_\_\_\_ Ft³/Ft

Super Sk. or Batch No.	Weight of Sand Bag(s) (lbs.)	Volume Bag(s) or Batch (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
1	2000	2.27	~27	665	702	720-702	05 tacho super sack
1	200	2	~29	689	690	From 5' to 7'	colorado Fine silica sand, 4 50 lb bags
1	—	2.2	31.2	676	—	605	14 gal water, 1 50 lb grout bag
2	—	2.2	33.4	662	—	605	"
3	—	2.2	35.6	648	—	605	"
4	—	2.2	37.8	634	—	605	"
5	—	2.2	40	620	—	605	"
6	—	2.2	42.2	606	—	605	"
7	—	2.2	44.4	592	—	605	"
8	—	2.2	46.6	578	—	605	"
9	—	2.2	48.8	564	—	520	"

Notes: Annular volume cubic feet per linear foot =  $(D^2 - d^2) \times 0.005454$

ALL DEPTHS ARE FEET BELOW LAND SURFACE

50 lbs bag of bentonite chips = 0.7 Ft³

Density of sand and gravel = 100 lbs/Ft³

Full super sack (sk.) of filter pack is 30 Ft³

Total Bags of Cement: —

Total Bags of Bentonite Gel: —

Total Bags of Bentonite Chips: —

Total Bags of Transition Sand: 4

Total Super Sacks of Filter Pack: 1

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38081</u>		Staff: <u>C Price</u>				
Well ID: <u>NSH-032</u>		Dates: <u>2-10-15</u>						
Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
10	✓	-	2.2	51	550	-	520	14 gal water, 1-50 lb grout bag,
11	✓	-	"	53.2	536	-	520	"
12	✓	-	"	53.4	522	-	520	"
13	✓	-	"	57.6	508	-	520	
14	✓	-	"	59.8	494	-	462	
15	✓	-	"	62	480	-	462	
16	✓	-	"	64.2	466	-	462	
17	✓	-	"	66.4	452	-	462	
18	✓	-	"	68.6	438	-	462	
19	✓	-	"	70.8	424	-	462	
20	✓	-	"	73	410	-	395	
21	✓	-	"	75.2	396	-	395	
22	✓	-	"	77.4	382	-	395	
23	✓	-	"	79.6	368	-	395	
24	✓	-	"	81.8	354	-	395	
25	✓	-	"	84	340	-	395	
26	✓	-	"	86.2	326	-	395	
27	✓	-	"	88.4	312	-	395	
28	✓	-	"	90.6	298	-	395	
29	✓	-	"	92.8	284	-	395	
30	✓	-	"	95	270	-	395	

Notes:

# ANNULAR MATERIAL RECORD

Project: Excelsior

Project No.: 38661

Staff: C Price, J. Nielsen

Well ID: NSH-032

Dates: 11-2-10-15

Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
31	✓	-	2.2	97.2	256	-	395	14 gal water, 1 50 lb grout bag
32	✓	-	"	99.4	242	-	395	
33	✓	-	"	101.6	228	-	395	
34	✓	-	"	103.8	214	-	395	
35	✓	-	"	106	200	-	395	
36	✓	-	"	108.2	186	-	395	
37	✓	-	"	110.4	172	-	395	
38	✓	-	"	112.6	158	-	395	
39	✓	-	"	114.8	144	-	395	
40	✓	-	"	117	130	-	395	
41	✓	-	"	119.2	116	-	395	
42	✓	-	"	121.4	102	-	395	
43	✓	-	"	123.6	88	-	395	
44	✓	-	"	125.8	74	-	395	
45	✓	-	"	128	60	-	395	
46	✓	-	"	130.2	46	-	395	
47	✓	-	"	132.4	32	-	395	
48	✓	-	"	134.6	18	-	395	
49	✓	-	"	136.8	4	-	395	
50	✓	-	"	139.0	0	245	145	Tagged up tremie pipe; cement seen @ ~145 when removing tremie
51	✓	-	"	141.2	-	-	145	

Notes:

11/11/11

# ANNULAR MATERIAL RECORD

Project: <u>Excelsior</u>		Project No.: <u>38681</u>		Staff: <u>S. Nelson</u>				
Well ID: <u>N5H-032</u>		Dates: <u>2/10/15</u>						
Super Sk. or Batch	✓	Weight of Sand (lbs.)	Volume Bag(s) or (ft³)	Total Vol. Installed (ft³)	Calculated Depth (feet)	Tagged Depth (feet)	Bottom of Tremie (feet)	Annular Material Description (including number of bags & bag weight and batch mix and density for slurry)
52	✓	-	2.2	143.4	0	-	145	14 gal water; 1-50 lb bags of grout
53	✓	-	"	145.6	0	-	145	
54	✓	-	"	147.8	0	-	145	
55	✓	-	"	150.0	0	-	145	
56	✓	-	"	152.2	0	-	145	
57	✓	-	"	154.4	0	-	145	
58	✓	-	"	156.6	0	-	145	
59	✓	-	"	158.8	0	-	145	
60	✓	-	"	161.0	0	-	145	
61	✓	-	"	163.2	0	-	85	
62	✓	-	"	165.4	0	-	85	
63	✓	-	"	167.6	0	-	45	
64	✓	-	"	169.8	0	-	45	
65	✓	-	"	172.0	0	-	45	
66	✓	-	"	174.2	0	-	45	
67	✓	-	"	176.4	0	-	45	
68	✓	-	"	178.6	0	-	45	
69	✓	-	"	180.8	0	-	45	
70	✓	-	"	183.0	0	-	45	
71	✓	-	"	185.2	0	-	45	
72	✓	-	"	187.4	0	-	45	

Notes:

[illegible]



SHD BE 2 LFT

## PIPE TALLY for CASING &amp; SCREEN

Project Name.: <u>Excelsior</u>	Project No.: <u>39687</u>
Well Site: <u>N5H-032</u>	Date: <u>2/1/15</u>
Location: <u>N. OF E-10</u>	Staff: <u>GPF</u>

Type of Connections: ☐ Welded ☒ T+C ☐ Flush Thread ☐ Other

Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type	Pipe	✓	Length (ft)	Length Σ (ft)	Pipe Type
1		21.15	21.15	Perf 2 3/8" OD	37		21.09	779.04	
2		21.10	42.25	"	38		21.12	800.16	
3		21.08	63.33	"	39		21.03	821.19	
4		21.12	84.45	"					
5		20.95	105.40	Blank 2 3/8" OD					
6		21.13	126.53						
7		21.12	147.65						
8		21.09	168.74						
9		21.10	189.84						
10		21.08	210.92						
11		21.13	232.05						
12		20.90	252.95						
13		20.98	273.93						
14		20.73	294.66						
15		21.12	315.78						
16		21.09	336.87						
17		21.3	358.20						
18		21.02	379.22						
19		21.10	400.32						
20		20.95	421.27						
21		20.99	442.26						
22		21.00	463.26						
23		20.95	484.21						
24		20.90	505.11						
25		21.06	526.17						
26		21.15	547.32						
27		21.12	568.44						
28		21.05	589.49						
29		21.00	610.49						
30		21.10	631.59						
31		21.10	652.69						
32		21.12	673.81						
33		21.08	694.89						
34		21.06	715.95						
35		21.10	737.05						
36		21.00	758.05						

cut off PERF 2 3/8" OD  
 TOTAL STRING 15 806'  
 INCL. STICKUP.

SCREEN 720-804



## **APPENDIX C**

### **Well Development Field Forms**

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.:
Well No.: <u>NSH-007</u>	Date: <u>10-23-2014</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP OF BOP, 3.3' STICK UP</u>
Total Depth of Well (ft bls): <u>620</u>	Screen Interval (ft bls): <u>469-620</u>
Pump Type/Setting (ft bls): <u>Air Lift</u>	Activity: <u>WATER DEVELOPMENT</u>
How Q Measured: <u>TIME TO FILL SEAL</u>	H&A Personnel: <u>J. Cook, C. Gardner</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
11:10	~23	—	—	16	—			Swabbing with bit.
11:20	~20	—	—	20	—			Air lift.
11:30	~21	—	—	15	—			Swab with Bit
11:40	~20	—	—	20	—			Air lift
11:50	~20	—	—					Air lift
11:53	0	SHUT OFF	AIR FOR	RISEING HEAD TEST				
11:58	0	484.2	FT/MIN					
12:00		480						
12:00:44	478	2.7	12:10:35	438				HISTORICAL
12:01:18	476		12:11:25	436	2.4			
12:02	474		12:12:25	434				0330 424-400 2 ft/min
12:02:38	472	3.1	12:13:25	432				
12:03:00	470	5.5	12:14:30	430	1.8			445 451-417 3 ft/min
12:03:13	468	9.2	12:15:58	428	1.5:50			605 461-425 3 ft/min
12:03:30	466	7.0	12:17:00	426	2.6 (462-420)			
12:03:50	464	6.0	12:18:25	424				
12:04:10	462		12:19:55	422				1020 420-415 1 ft/min
12:04:30	460	6.0	12:21:35	420	1.2			
12:04:55	458		12:23:25	418	1.8 (450-416)			1.0 ft/min (420-414)
12:05:20	456		12:25:15	416				
12:05:45	454	4.8	12:27:20	414	1.0 (424-408)			
12:06:10	452		12:29:35	412				
12:06:40	450	4.0	12:32:00	410	1.0			
12:07:15	448		12:34:30	408				
12:07:45	446							
12:08:25	444	3.4						
12:09:00	442							
12:09:45	440	2.7						
Comments:								

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>DUGESIOR</u>	Project No.:
Well No.: <u>NSH-007</u>	Date: <u>10-23-14</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP OF BOP, 3.3' STICKUP</u>
Total Depth of Well (ft bls): <u>620</u>	Screen Interval (ft bls): <u>469-620</u>
Pump Type/Setting (ft bls): <u>AIR LIFT</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>5 gal BUCKET</u>	H&A Personnel: <u>S. COOK, C. GARDNER</u>

Time	Discharge (gpm)	<del>Pumping</del> Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1256				20				SWAB ~20% GRAVEL
1305				12				AIRLIFT ~20% GRAVEL
1316				8				AIRLIFT, 0% GRAVEL
1321 20				7				SWAB, ~10% GRAVEL
1340				6				AIRLIFT, ~15% GRAVEL
1405				6				AIRLIFT, ~5% GRAVEL
1406	STOPPED	AIRLIFT FOR RISING HEAD TEST						
14:11:25	484				14:21:30	444		
14:11:55	482				14:22:10	442		3.4 3.0
14:12:30	480				14:22:45	440		3.4
14:13:15	478	2.7			14:23:40	438		
14:13:50	476				14:24:30	436		
14:14:30	474				14:25:30	434		
14:15:15	472				14:26:35	432	1.8	
14:15:35	470	6.0			14:27:40	430	1.8	
14:15:50	468	8.0			14:29:00	428		
14:16:10	466	6.0			14:30:25	426	1.4	
14:16:30	464	6.0						
14:16:50	462							
14:17:10	460	6.0						
14:17:35	458							
14:18:00	456							
14:18:30	454	4.0						
14:19:00	452							
14:19:30	450	4.0						
14:20:05	448							
14:20:40	446							
Comments:								



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXPLOR</u>	Project No.:
Well No.: <u>NSH-007</u>	Date: <u>10-23-14</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP OF BOP, 3.3' STICKUP</u>
Total Depth of Well (ft bls): <u>6020</u>	Screen Interval (ft bls): <u>469-620</u>
Pump Type/Setting (ft bls): <u>AIRLIFT</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>5 gal BUCKET</u>	H&A Personnel: <u>J. COOK, C. GARDNER</u>

Time	Discharge (gpm)	<del>Pumping</del> Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
1450				7	MIN 2 Q12 POST			SURGE, ~20% GRAVEL
1500	30			18	MIN 2 Q12 POST			AIRLIFT ~40% GRAVEL
1520	23			19	"			AIRLIFT ~20% GRAVEL
1530	23			25	"			AIRLIFT ~20% GRAVEL
1545	-			7	"			AIRLIFT ~15% GRAVEL
1600	16			15				SWAB, ~20% GRAVEL
1620	16			11				AIRLIFT ~10% GRAVEL
1630				7				AIRLIFT 5-10% GRAVEL
1632	SHUT OFF AIR FOR RISING HEAD TEST							
1640		484	STARTED STOP WATCH @ 1640					
0:50 sec		482	ft/min					
1:40		480	2.4		12:45	440		
2:40		478			13:40	444		
3:30		476			14:35	442		
4:25		474	2.2		15:35	440	20	
5:20		472			16:40	438		
5:45		470	4.8		17:30	430		
6:10		468	4.8		19:10	434		
6:35		466	4.8		20:30	432		
7:00		464			22:00	430	1.3	
7:30		462						
8:00		460	4.0					
8:35		458						
9:10		456						
9:45		454						
10:30		452						
11:10		450	3.0					
11:55		448	2.7					

Comments: 3X 60 AIRLIFT / 15  
AFTER 3X AIRLIFT → RISING HEAD TEST

W.L. RISE RATE = 120/50C

DEVELOPMENT  
FIELD DATA LOG

Project Name: <u>ONCE 5102</u>	Project No.:
Well No.: <u>NSH-007</u>	Date: <u>10-23-14</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP of BOP 33' STEELUP</u>
Total Depth of Well (ft bls): <u>620</u>	Screen Interval (ft bls): <u>469-620</u>
Pump Type/Setting (ft bls): <u>AIRLIFT</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>Seal Bucket</u>	H&A Personnel: <u>B. Kienberger</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand + Gravel Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1730	—			10				Surge, ~15% Gravel
1740	—			9				Airlift ~10% Gravel
1750	20			6				Airlift ~10% Gravel
1800	20			5				Airlift ~10% Gravel
1810	15			4				Airlift ~10% Gravel
1820	15			4				Airlift ~5% Gravel
1830	15			2.5				" ~5% "
1845	—			0.4				Surge 0% Gravel
1855	16			8				Airlift 5% "
1905	23			8.5				" 10% "
1915	23			9				" 10% "
1925	17			4.5				" 5% "
1935	17			5				" 5% "
1945	17							
	U-ps	487						
1954	T. (see)	485						
1958	17	473	7.0					
1958	29.86	471						
1959	17	469	7.0					
1959	17	467	7.0					
2000	14	465	8.6					
2000	13	463	9.2					
2000	19	461	6.3					
2001	11	459	10.9					
	19	457	6.3					
	12	455	10					
2002	12	453	10					
	13	451	9.2					

Comments: Flow Rate = 300 / TIME IN SEE TO RUN Seal  
Not particularly good of data if rising head test.

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: _____
Well No.: <u>NSH-007</u>	Date: <u>10/23/14</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>Top of BOD 3.3' Stickup</u>
Total Depth of Well (ft bls): <u>620</u>	Screen Interval (ft bls): <u>469' - 620'</u>
Pump Type/Setting (ft bls): <u>Air Lift</u>	Activity: <u>Air Lift Development</u>
How Q Measured: <u>5 Gallon Bucket</u>	H&A Personnel: <u>B. Kienberger</u>

[illegible]

Comments: Stopped Developing Wall @ 21:14

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well Site: <u>NSH-007</u>	Date: <u>2/11/15</u>
Location:	Cased Depth (ft, bls): <u>469' (open hole - 640)</u>
Total Depth of Corehole (ft, bls): <u>640</u>	Measuring Point:
How Q Measured: <u>Visual Estimate</u>	Staff: <u>S. Nielsen</u>

[illegible]

Project Name: EXCELSIOR	Project No.: 38681
Well No.: NSH-007	Date: 2-16-15, 2-17-15
Location:	Measuring Point: TOP OF PVC (1.88' stickup)
Total Depth of Well (ft bls): 620	Screen Interval (ft bls):
Pump Type/Setting (ft bls): 405 / 594	Activity: DEVELOP
How Q Measured: EM METER	H&A Personnel: K Ford

[illegible]



## CALCULATIONS

File No.

Sheet

1 of 5

Date

2-17-15

Computed By

Checked By

Client EXCELSIOR

Project

Subject DEVELOP / STEP RATE NSM-007

Static water: 348.24 bmp (top of PVC = 1.88 ft skidup ABOVE TOP OF PWS)								
Time	Discharge	Water level	Sp. Draw (ft/gpm)	Sand	pH	Sp Cond	Temp.	Comments
0700	Start pumping, make sure			no mud	poly,	adjust	Flow to	~8 gpm
0705	8.51	(sound & plugged)	-	0.1	5.91	413	17.03	clear
0715	8.28	406.81	7.1	<0.1	6.88	476	20.11	clear
0725	8.34	410.78	7.5	<0.1	7.03	473	19.95	clear
0730	Adjusted flow (meter clogged)			<0.1	7.22	464	19.08	clear
0735	8.56	417.68	8.1	<0.1	7.13	476	20.52	clear
0740	8.46	420.30	8.5	0	7.25	476	20.42	clear
0745	8.51	422.46	8.7	0	7.31	473	20.20	clear
0750	8.46	424.45	9.0	0	7.17	476	20.62	clear
0755	8.46	426.11	9.2	0	7.28	475	20.33	clear
0800	8.46	427.22	9.3	<0.1	7.27	475	20.58	clear
0802	Open valve fully - max flow							
0807	43.64	490.90	3.3	0.1	7.14	472	19.88	clear
0810	42.08	509.35	3.8	0.1	7.12	473	19.98	clear
0815	41.85	511.90	3.9	0.1	7.12	470	20.08	clear
0820	41.35	519.81	4.1	0.1	7.11	474	20.12	clear
0825	40.79	528.40	4.4	<0.1	7.14	476	20.42	clear
0830	40.79	529.35	4.4	<<0.1	7.12	474	20.10	clear
0842	38.34	565.90	5.6	<0.1	7.13	478	20.60	clear
0850	20.24	577.35	11.3	<0.1	7.21	471	20.71	clear
0855	20.42	576.80	11.2	<0.1	7.18	476	21.11	clear
0900	20.24	576.80	11.3	<0.1	7.15	475	21.18	clear
0908	19.18	577.02	11.9		7.14	478	21.32	clear
0910	Stop pumping, recover ~ 1/2 hour							
0915		546.23						
0920		530.72						
0925		529.70						
0930		529.67						
0935		527.95						
0940		524.76						
0945		517.80		486.20				
0950		512.63						
0955		511.30						
1000		509.83						
1005		500.57						

## DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXPERSON</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-007</u>	Date: <u>2-17-15</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP OF 1" PVC 2-30' als</u>
Total Depth of Well (ft bls): <u>618</u>	Screen Interval (ft bls): <u>358-498, 538-618</u>
Pump Type/Setting (ft bls): <u>405100-30 &amp; 592'</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>GPI PROBESON 1 1/2"</u>	H&A Personnel: <u>S. COLLINGS</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
								STATIC & <del>3</del> 348.24' bmp
1010	STARTED PUMPING							26gpm CLOSING VALVE
1013	2.2	495.6						
1015	"	491.1						
1020	3.76	485.14						DIFFICULT TO ADJUST RATIO, BALL VALVE AND GPI SENSITIVE AT LOW PRESS
1025	3.81	479.10						AS: 130.92 ft
1030	3.64	473.94						
1035	3.76	466.65						
1040	3.86	456.95						
1045	3.92	448.92						AS: 100.6 ft
1050	4.09	442.38						
1055	4.08	436.98						
1100	4.08	432.47						
1105	4.08	428.75						
1110	4.08	425.51						
1115	4.14	422.85						
1120	4.20	420.58						
1125	4.14	418.43						
1130	4.14	416.86						
1135	4.14	415.37						
1140	4.20	414.03						
1145	4.14	412.94						AS: 64.7 ft
1150	4.20	411.84						
1155	4.20	410.81						
1200	4.20	410.08						
1205	4.30	409.24						
1210	4.20	408.63						
1215	4.20	408.02						AS: 59.78 ft
1220	4.20	407.41						

Comments:

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# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>381681</u>
Well No.: <u>NSH-007</u>	Date: <u>2/17/15</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>Top of 1" PVC - 2.30' a/s</u>
Total Depth of Well (ft bls): <u>618</u>	Screen Interval (ft bls): <u>358-498, 538-618</u>
Pump Type/Setting (ft bls): <u>405100-30e 592</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPT Propeller 1 1/2"</u>	H&A Personnel: <u>S. Collinge</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
								STATIC @ 318.24
1225	4.20	406.95						
1230	4.20	406.49						
1231								Increase Flow to 12 gpm
1235	12.00	417.91						
1240	11.90	429.06						
1245	11.74	431.55						AS=89.31
1250	11.63	444.23						
1256	11.58	450.51						
1300	11.52	453.96						
1305	11.41	457.60						
1310	11.41	460.35						
1315	11.36	462.78						
1320	11.36	464.85						
1325	11.30	466.60						Δ = 118
1330	11.30	468.31						
1336	11.30	469.59						
1340	11.24	470.45						
1345	11.24	471.16						
1353	11.19	471.70						
1355	11.24	471.92						
1400	11.15	472.80						Shut down Pump
1404	—	465.01						
1408	—	448.05						
1406	—	436.41						
1407	—	430.13						
1410	—	423.02						
1415	—	413.06						
1420		410.21						

Comments:



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-007</u>	Date: <u>2/17/15</u>
Location: <u>NSA-CP</u>	Measuring Point: <u>Top of 1" PVC - 2.30' uk</u>
Total Depth of Well (ft bls): <u>618</u>	Screen Interval (ft bls): <u>958-498 538-618</u>
Pump Type/Setting (ft bls): <u>40S100-30 x 342</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPT Propeller 1 1/2"</u>	H&A Personnel: <u>S. Collinge</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1425	=	3498.47						
1430	=	3499.41	Adjust flow to 46 gpm					Restarted @ 1430 @ 16 gpm
1433		425.41						
1436		437.02						
1438	15.84	444.10						
1440	15.67	448.97		⊖	6.55	456	20.23	11.3 turb Adjusted Flow
1445	16.22	463.46		⊖		47	20.68	3.8 turb
1450	16.06	471.77		0	7.03	474	20.68	3.8 turb
1455	15.94	475.65						4
1500	15.85	479.25						
1505	15.84	482.88						
1510	15.72	485.69						
1515	15.62	490.58		⊖	7.19	472	20.68	9.73 turb
1520	15.50	495.05						
1525	15.40	499.39		⊖	7.19	473	20.75	0.63 turb
1530	15.40	501.70						
1535	15.34	503.18		⊖	7.21	474	20.82	1.26 turb
1540	15.28	505.55						
1545	15.22	507.83		⊖	7.19	472	20.82	0.57 turb
1550	15.16	508.92						
1555	15.16	509.26		⊖	7.20	475	20.90	0.59 turb
1600	15.10	509.58						
1605	15.10	509.83		⊖	7.15	473	20.71	0.81 turb
1610	15.16	510.09						
1620	15.10	510.52		⊖	7.18	471	20.70	4.57 turb
1630	15.10	510.88						
1640	15.00	511.12			7.22	470	20.61	.83 turb
1650	15.10	511.61						

Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXPLORATION</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-007</u>	Date: <u>2/17/15</u>
Location: <u>NSH-CP</u>	Measuring Point: <u>TOP OF 1" PVC @ 2.3' abs</u>
Total Depth of Well (ft bls): <u>668</u>	Screen Interval (ft bls): <u>358-498, 538-668</u>
Pump Type/Setting (ft bls): <u>405/100-30 @ 592'</u>	Activity: <u>PUMP DECOMMISSION</u>
How Q Measured: <u>GPH PROPELLER</u>	H&A Personnel: <u>C. GARDNER</u>

[illegible]

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Project Name: <u>EXC-0510R</u>	Project No.: <u>38681</u>
Well No.: <u>NSA 008</u>	Date: <u>10/26/14</u>
Location: <u>NSA-CR</u>	Measuring Point: <u>TOP</u>
Total Depth of Well (ft bls): <u>900'</u>	Screen Interval (ft bls): <u>OPEN B TO 40 900'</u>
Pump Type/Setting (ft bls): <u>AIRLIFT FROM TD</u>	Activity: <u>BO HOLE D VERD ON</u>
How Q Measured: <u>VISUAL EST.</u>	H&A Personnel: <u>JAN NICK, UK</u>

[illegible]

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Project Name: <u>EXCALIBUR</u>	Project No.: <u>33681-204</u>
Well No.: <u>NSH-003</u>	Date: <u>10/30/14</u>
Location: <u>NSH-CQ</u>	Measuring Point: <u>LAND</u>
Total Depth of Well (ft bls): <u>840</u>	Screen Interval (ft bls): <u>720-840</u>
Pump Type/Setting (ft bls): <u>AIRLIFT FROM CAS</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>VISUAL ESTIMATE</u>	H&A Personnel: <u>C. GARDNER, P. ANDERSEN</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
0440	DIFFICULT TO			3.0	TURBID			AIRLIFT SURGE
0445	ESTIMATE			TR	CLOUDY			STATIC ENSH-007, 326.66' bmp
0455	~10			TR	CLEAR			
0500	SHUT OFF AIRLIFT							INDICATOR
0515	~10			0.2	CLOUDY			@ 695 (AIRLINE)
0530	↓			0.2	not TURBID-CLOUDY			
0600	↓			0	CLEAR			
0605	0							ADDING 2 STS AIRLINE TO 735'
0607	0							DTW @ NSH-007 @ 338.05' bmp
0620	0							DTW @ NSH-003 @ 432' DTOL ~6' w/ AND RISING
0630	~10							AIRLIFT SURGE
0635	↓			OH	~90% FILTER PACK			TURBID
0650	↓			0	CLOUDY			
0655	0			0.4	0.2			TURBID TO CLOUDY AIRLIFT SURGE
0730	~15			TRACE				CLOUDY TO CLEAR, 41 NTU
0750								
0755	0							DTW @ NSH-007: 344.85' bmp
0800	0							008 add 1 joint + 0.5' bottom @ 755'
0810	~15			0.1	Turbid			
0840	~15			TR	CLOUDY-CLEAR			, 53.3 NTU
0840+	0							
0855	~15							AIRLIFT SURGE
0900	~15			TR	16.7 NTU			TURBID-CLOUDY
0910	~15			TR	10.3 NTU			"
0910+	0							ADDING 1ST TROUBLE TO 775.
Comments: TURBIDITY MEASURED VISUALLY AND MEASURED WITH HACH 2100Q (DRILLER'S)								
SAND CONTENT MEASURED WITH AN EMHOFF CONE								



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Project Name: <u>Excelsior</u>	Project No.: <u>35651-204</u>
Well No.: <u>NSH-008</u>	Date: <u>10-30-14</u>
Location: <u>NSH-CR</u>	Measuring Point: <u>Land</u>
Total Depth of Well (ft bls): <u>540</u> <u>VARIOUS</u>	Screen Interval (ft bls): <u>720-540</u>
Pump Type/Setting (ft bls): <u>Airlift, From 695</u>	Activity: <u>Airlift development</u>
How Q Measured: <u>Visual Estimate</u>	H&A Personnel: <u>C. GARDNER, C. PRICE</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (gpm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
0924	~15			0.1	479	NTU		Turbid, Bottom Airlift
0935	~15			0.1				Turbid @ 775'
0950	~15			TR	106	NTU		Cloudy/clear
0951+	0							
1000	~15			0.2				Cloudy - turbid
1025	~15			TR	73.4	NTU		Cloudy
1030	0							
1045	~15							STARTED AIRLIFT
1050				0.2				turbid-cloudy
1105				TR				Cloudy
1120	~15							Airlift @ 795'
1140	~15			0.4				Turbid
1155	~15			TR	123	NTU		Cloudy
1155+	0							
1210	~15							
1220				TR				Cloudy - turbid
1230				TR	106	NTU		Cloudy
1230+	0							
1245	~15							Airlift @ 815'
1255	~15			0.4				Turbid w/ some filter pack
1305	0			TR				Turbid-cloudy 425 NTU
1320	~15							
1330	~15			TR				Turbid-cloudy 340 NTU
1330+	0							
1345	~15							Airlift to 835'
1355	~15			2.0				w/ 220' filter pack turbid
1410	~15			TR				turbid-cloudy
1410+	0							

Comments:



Project Name: EXCLUSOR	Project No.: 38081-704
Well No.: NSH-008	Date: 10-30-14
Location: NSH-CQ	Measuring Point: LAND
Total Depth of Well (ft bls): 840	Screen Interval (ft bls): 770-840
Pump Type/Setting (ft bls): AIRLIFT	Activity: AQUIF DEVELOPMENT
How Q Measured: VISUAL ESTIMATE	H&A Personnel: C. GARDNER

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
1425	~15							AIRLIFT SURGES
1430	~15			4.0		TURBID		~10% FILTER PACK
1440	~15			TR		TURBID-CLOUDY		448 NTU
1440+	0							
1450	~15							
1455	↓			0.3		FINES (MUD) TO ~		3.0, TURBID
1505	↓			TR		TURBID-CLOUDY		558 NTU
1505+	0							
1515	~15			0.6		CLOUDY - TURBID		
1530	0							
1545	~15							
1555	0					DOWN 154-007		361.34 bmf
1600	~15							
1610	~15							
1620								
1615	0							
1620	~15							
1630	0					END OF AIRLIFT DEVELOPMENT		

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXCE/SIOR</u>	Project No.: <u>38681-205</u>
Well No.: <u>NS11008</u>	Date: <u>12/22/14</u>
Location: <u>N. OF I-10, NR THE THING</u>	Measuring Point: <u>TOP OF MON. ; SWL = 336.33</u>
Total Depth of Well (ft bls): <u>SURN: 720-840</u>	Screen Interval (ft bls): <u>720-840</u>
Pump Type/Setting (ft bls): <u>NA</u>	Activity: <u>SWAB &amp; BAIL</u>
How Q Measured: <u>NA</u>	H&A Personnel: <u>GO</u>

[illegible]

# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXLORSIDR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-008</u>	Date: <u>1-5-15</u>
Location: <u>NSH-CQ</u>	Measuring Point: <u>TOP OF 1" PVC, 3.73' STICK UP</u>
Total Depth of Well (ft bls): <u>840</u>	Screen Interval (ft bls): <u>720 - 840</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE / 709</u>	Activity: <u>PUMP AND SINGE</u>
How Q Measured: <u>FM FLOW METER</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft) BMP	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F °C	Comments
1150	0	337.1	—					STATIC WATER LEVEL
1153	STARTED PUMPING, ADJUSTING VALVE							
1157	2.9							TURNING TO
1159	5.36			0.0	7.5	270	20.8	WHITE w/ AIR → CLEAR
1201	7.46	397.80						
1205	7.07	398.60	8.7	0.0	7.9	260	21.9	WHITE w/ AIR → CLEAR
1210	7.24	402.85	9.1	0.0	7.6	410	21.8	WHITE → CLEAR
1216	7.18	408.90	10.0	0.0	7.5	410	22.2	CLOUDY w/ AIR → CLEAR
1218	ADJUSTING VALVE TO ~10 gpm							
1221	0							
1224	0	356.9	REVERSING DROPPING					356.9 PWL
1231	0	358.5	RISING					
1232	0	358.5						
1232+	STARTED PUMPING							
1237	10.44	423.3	8.3	0.0	7.5	360	23.4	WHITE → CLEAR
1242	10.33	432.1	9.2	<0.1	7.5	420	22.7	WHITE → CLOUDY
1247	10.22	440.2	10.1	<0.1	7.4	390	24.2	WHITE → CLEAR
1252	10.11	445.6	10.7	<0.1	7.4	400	23.9	WHITE → CLEAR
1253	0	ADJUSTED VALVE TO ~15 gpm						
1300	STARTED PUMPING							
1305	15.45	469.20						
1310	—	486.91	~40.2					~14.72 gpm EST
1320	—	503.45	~11.3					~14.44 gpm ESTIMATED
1320	0							
1330	PUMPING							
1343	14.72	503.2	11.3	0.0	7.6	340	22.0	1343 CLOUDY → CLEAR
1350	14.44	512.30	12.1					AS = 175 FEET
1350+	ADJUSTED TO ~20 gpm							
Comments:								

# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXLORSIDR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-008</u>	Date: <u>1-5-15</u>
Location: <u>NSH-CQ</u>	Measuring Point: <u>TOP OF 1" PVC, 3.73' STICK</u>
Total Depth of Well (ft bls): <u>840</u>	Screen Interval (ft bls): <u>720-840</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE / 709</u>	Activity: <u>PUMP + SURGE</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. GANNON</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F / °C	Comments
1400	STARTED PUMPING							
1405	19.97	523.2	9.3	0.0	7.6	410	23.8	STATIC 337.1' bms TURNS TO WHITE → CLOUDY
1410	19.24	543.6	10.7	<0.1	7.4	410	24.1	WHITE → CLEAR FINE BLACK PARTICLES
1415	18.79	556.0	11.6	<0.1	7.4	390	24.8	CLOUDY → CLEAR
1420	18.50	564.2	12.3	-	-	-	-	ΔS = 227.1'
1420+	ADJUST TO ~25 gpm							
1421	0							
1430	PUMPING ~28 gpm							
1435	24.90	578.7	9.7	<0.1	7.4	400	24.6	CLOUDY → CLEAR
1440	23.50	602.5	11.3	<0.1	7.3	380	24.7	CLOUDY → CLEAR
1445	22.66	614.8	12.3	<0.1	7.3	390	24.7	CLOUDY → CLEAR
1450	22.16	623.8	12.9	<0.1	7.3	400	24.7	CLOUDY → CLEAR
1450+	ADJUST TO ~30 gpm GATE 100% OPEN							
1451	0							
1500	PUMPING ~35 gpm, GATE DOWN							
1505	27.34	624.1	10.4	<0.1	7.2	400	24.7	CLOUDY → CLEAR ADJUSTED TO 30 gpm 100% OPEN
1510	27.20	660.1	11.9	0	7.3	400	24.4	CLOUDY → CLEAR
1515	25.93	671.9	13.2	0	7.2	390	24.7	CLOUDY → CLEAR
1520	25.02	680.3	13.7	0	7.2	400	24.5	CLEAR ΔS = 343.2'
1530	-	689.5	-	-	-	-	-	ΔS = 352.4'
1559	0	447.0						
1600	STARTED PUMPING ADJUSTING TO ~10 gpm							
1601	11.6	ADJUSTING RATE						
1605	10.78	512.2	16.2	0	7.6	400	24.1	CLOUDY w/ AIR → CLEAR
1610	10.72	514.2	16.5	0	7.4	400	24.5	CLOUDY w/ AIR → CLEAR
1615	10.72	517.2	16.8	-	-	-	-	
1620	10.72	518.5	16.9	0	7.4	410	24.6	CLEAR
Comments:								

## Page 3 of 3

Project Name: <u>EXCURSION</u>	Project No.: <u>32681</u>
Well No.: <u>NSH-008</u>	Date: <u>1-5-15</u>
Location: <u>NSH-CQ</u>	Measuring Point: <u>TOP OF 1" PVC, 3.73' STICK UP</u>
Total Depth of Well (ft bls): <u>840</u>	Screen Interval (ft bls): <u>720-840</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE / 709</u>	Activity: <u>PUMP + SING</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. GARDNER</u>

[illegible]

R16  
DEVELOPMENT  
FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-009</u>	Date: <u>11/6/14 - 11/7/14</u>
Location: <u>NSH-CS</u>	Measuring Point: <u>NONE</u>
Total Depth of Well (ft bls): <u>1018?</u>	Screen Interval (ft bls): <u>835' - 1015'?</u>
Pump Type/Setting (ft bls): <u>AIRLIFT w/ TROMIE</u>	Activity: <u>D. HUCKLE, C. GARDNER, G. FOSTER, FOSTER</u>
How Q Measured: <u>visual estimate</u> <u>VARIOUS</u>	H&A Personnel: <u>D. Huckle</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1345	10			~30				
1510	10			"				trans. sand observed in well
1614	10			~50				hemix at 810' -
1634	10			0.3				hemix at 810'
1700	TROMIE (AIRLINE) PLUGGED w/ TRANSITION SAND, TRAPPING OUT							
1845	TROMIE AIRLINE @ 820' LIFTING OUT TRANSITION SAND							
	AND GRAY WATER FROM GRUNT							
1915	AIRLINE @ 830' MAKING GRAY WATER AND ~1 ml/L TRANS. SAND							
1920	TAGGED w/ AIRLINE @ 845' (TOP OF FILL IN WELL)							
1930	~10	FORM. SAND		1.0	TURBID			AIRLINE @ 830'
2050	~10	FORM, minor solids		1.0	TURBID			AIRLINE @ 840'
2245	~10	"	"	1.0	ORANGE - colored			AIRLINE @ 845'
2302	~10	"	"	1.0	GRAY			AIRLINE @ 850'
2340	10	"	"	1.0	GRAY			AIRLINE @ 855'
0015	10	"	"	1.0	GRAY			AIRLINE @ 860'
0050	10	"	"	1.0	GRAY			AIRLINE @ 870'
0125	10	"	"	1.0	GRAY			AIRLINE @ 880'
0150	10	"	"	1.0 (15)	ORANGE			AIRLINE @ 890'
0214	10	"	"	13	ORANGE			AIRLINE @ 900'
0245	10	FORM		2	TAN			AIRLINE @ 910'
0330	10	FORM, FN SAND		1	TAN-ORANGE			AIRLINE @ 920'
0350	10	FN SAND, FORMING		1	ORANGE			@ 930'
0437	10	FN SAND		2	ORANGE			@ 940'
0507	10	TR. FN SAND		<1	TAN			@ 950'
0522	10			~1				@ 960'
0641	10	some foam		<0.5	tan			@ 970'
0740	10			<0.5	light tan			@ 980'
0835	10			<0.5	6.7	450	19.7	@ 990' observe gravel 2nd sample to ground

Comments:

Observed transition sand in first air lift, stopped to discuss.  
Continued to clear out well.

Project Name: <u>Excelstar</u>	Project No.: <u>30681</u>
Well No.: <u>NSH-004</u>	Date: <u>11/7/14</u>
Location: <u>NSH-CS</u>	Measuring Point:
Total Depth of Well (ft bls): <u>1018'</u>	Screen Interval (ft bls): <u>835'-1015'</u>
Pump Type/Setting (ft bls): <u>A-121 w/ 1/2" pipe</u>	Activity: <u>1</u>
How Q Measured: <u>visual estimate</u>	H&A Personnel: <u>D. Hatcher</u>

[illegible]

## DEVELOPMENT FIELD DATA LOG

SWL = 408.92 BTC

Project Name: EXCEL/6102	Project No.: 38681-205
Well No.: N/SH-009	Date: 12/22/14
Location: N. OF I-10, N.R. THITTENA	Measuring Point: TOP OF MONUMENT, 3.0' ALS
Total Depth of Well (ft bls): 995	Screen Interval (ft bls): 813-995'
Pump Type/Setting (ft bls): NA.	Activity: SWAB/BAIL
How Q Measured: N/A	H&A Personnel: GF

[illegible]



## Page 1 of 1

[illegible]

HALEY &amp; ALDRICH

# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-009</u>	Date: <u>1-4-2015</u>
Location: <u>NSH-05</u>	Measuring Point: <u>TOP OF 1" PVC 358' STICKUP</u>
Total Depth of Well (ft bls): <u>995</u>	Screen Interval (ft bls): <u>813-995 FEET</u>
Pump Type/Setting (ft bls): <u>Q37/SUBMERSIBLE</u>	Activity: <u>PUMP &amp; SURGE</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft) <small>BTOC</small>	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. <sup>°F</sup> / <sub>°C</sub>	Comments
0800	0	415.00	STATIC					WATER LEVEL BTOC 1" PVC
0803	STARTED PUMPING							
0804	43.5	-	-	0.04	7.0	420	20.0	TURBID-CLOUDY 0.0mg/l
0806	30	-	-	6.10 IN SPIGOT WHEN OPENED				
0810	12.6	636.20		0.0	6.9	430	21.5	CLOUDY
0815	12.1	636.20	→ BOTTOM SOUNDING TUBE					CLOUDY
0815+	0							
0820	0	468.7						
0825	0	453.1						
0826	STARTED PUMPING							
0827	39.6							TURBID-CLOUDY
0828	31.6							CLOUDY
0829	8.4							SOUNDING, CLOSING VALVE
0830	10.3							
0832	9.9	636.20						ADJUSTED VALVE
0833	6.6	623.6	RISING	0.0	7.0	480	22.4	CLOUDY
0837	6.7	617.3	RISING				22	
0840	6.9	604.6	RISING		7.2	450	23.3	CLEAR
0841	7.1	597.0	RISING	AS 182'		0.04gpm/ft		0845
0853	7.2	590.5	0.04		7.2	490	24.4	CLEAR
0900	7.24	588.45	24.0 ft/gpm					CLEAR
0905	7.24	588.25			7.2	480	25.1	CLEAR
0915	7.24	588.75		DRAWDOWN				
0920	7.24	589.40			7.3	500	25.0	CLEAR
0926	7.24	590.45					25.0	
0934	0	STOPPED PUMPING TO LOWER PUMP (5x21' JTS)						
								TO ~742 FEET ~742 FEET
								~750 FEET

Comments:

# Pump DEVELOPMENT FIELD DATA LOG

Page 2 of 3

Project Name: <u>EXCLUSION</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-009</u>	Date: <u>1-4-14-2015</u>
Location: <u>NSH-CS</u>	Measuring Point: <u>TOP OF 1" PVC (3.50' STICK UP)</u>
Total Depth of Well (ft bls): <u>995</u> <span style="margin-left: 50px;"><u>742'</u></span>	Screen Interval (ft bls): <u>813-995</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE 750</u>	Activity: <u>PUMP + SURGE</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. SANDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (ft <sup>3</sup> /gpm)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °C	Comments
1036	0	437.10	RISING	(SWL @ 415.0' b70C x 0800)				
1040	STARTED PUMPING							
1041	33	w/ ADJUSTING			TO	7.2 gpm		
1042	7.12							
1043	7.18	547.7		0.0	7.6	490	22.7	CLOUDY
1046	7.12	552.3						
1050	7.02	558.7	20.5 ft/gpm	0.0	7.4	490	23.5	CLOUDY
1058	6.90	566.6						
1102	6.90	569.58		0.0	7.2	470	24.3	CLEAR - CLOUDY
1105	6.90	572.05	22.8 ft/gpm					
1110	6.85	574.45	23.3		7.2	490	25.0	CLEAR
1115	6.85	576.40	23.6					
1120	6.85	578.00	23.8	0.0	7.3	480	25.3	CLEAR
1125	6.80	579.75	24.2					
1130	6.80	581.10	24.4					
1135	6.76	581.90	24.7	0.0	7.20	480	25.3	CLEAR
1140	6.74	583.15	24.9					
1140+	INCREASING TO ~10 gpm							
1141	10.33							
1144	10.00	610.6	20.2 ft/gpm		7.2	480	25.6	CLEAR, 0.0 SAND
1150	9.62	628.1	22.2	0.0	7.2	480	25.8	CLEAR
1200	9.17	640.5	26.3	25.2	7.2	480	25.8	CLEAR, 0.0 SAND
1210	9.00	653.5	26.5					
1215	9.00	656.2	26.8	0.0	7.2	480	25.7	CLEAR, DS=241.2'
1225	8.84	659.00	27.6	0.0	7.2	480	25.7	CLEAR, 26.0°C
1235	8.90	661.05	27.6					
1240	8.78	662.50	28.2	0.0	7.3	480	25.7	
1240+	INCREASING TO ~13 gpm							
Comments: EST MAX ~15 gpm, Proposed STEPS 7 gpm, 10 gpm, 13 gpm ACTUAL RATE ~6.4 ~8.8 11.7 * END OF 60 MIN w/o ADJUSTING VALVE								

Page 3 of 3

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-009</u>	Date: <u>1-4-15</u>
Location: <u>NSH-CS</u>	Measuring Point: <u>TOP OF 1" PVC (3.58' STICK UP)</u>
Total Depth of Well (ft bls): <u>995</u>	Screen Interval (ft bls): <u>813-995</u>
Pump Type/Setting (ft bls): <u>SUBMERS. @ 742</u>	Activity: <u>PUMP + SURGE</u>
How Q Measured: <u>BM FLOW METER</u>	H&A Personnel: <u>C. GANON</u>

[illegible]

Comments:  $742' + (3 \times 21') = 805' \sim 8' \text{ ABOVE SURFACE}$

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-010</u>	Date: <u>3/7/15</u>
Location: <u>NSH-CT</u>	Measuring Point: <u>Top of 1" PVC @ 1.4 ft abs</u>
Total Depth of Well (ft bls): <u>405.60-30c 675'</u>	Screen Interval (ft bls): <u>378-598 + 638-698</u>
Pump Type/Setting (ft bls): <u><del>638</del></u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPI 2" Propeller and</u>	H&A Personnel: <u>T. Nelson</u>

[illegible]

Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-010</u>	Date: <u>3/6/15</u>
Location: <u>NSH-CT</u>	Measuring Point: <u>Top of 1" PVC @ 1.4 ft abs</u>
Total Depth of Well (ft bls):	Screen Interval (ft bls): <u>378-598-638-698</u>
Pump Type/Setting (ft bls): <u>405/100-30 C 675'</u>	Activity: <u>Pump development</u>
How Q Measured: <u>GPE 2" Propeller and bucket test</u>	H&A Personnel: <u>T. Nelson</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
0615	T. Nelson - National onsite @ NSH-010 657.20 ft @ end of day 2/5/							
0640	0 gpm, dtw 567.91							begin pumping, starting @ ~5 gpm
	water; little cloudy							
0650	pretty clear, turbid							IMHOF test 0.2 ml/L
	dtw 600.25		~4.5 gpm					
0655	~2.42 gpm	dtw 623.98						
0701	~1.45 gpm	dtw 636.11						IMHOF 0.3 ml/L sand
0705	~1.23 gpm	dtw 646.40						
0710	~0.5 gpm	dtw 654.40						
0730	~0 gpm	dtw bottom, casing water						
	bucket test 5g/1.03 min ~4.85 gpm ~clear water							
0750	bucket test 5g/1.53 min ~3.27 gpm							
0810	bucket test 5g/1.05							
0830	bucket test 5g/1.0473 min							
0858	bucket test 5g/1.0693 min 4.5 gpm							
0910	IMHOF 0 ml/L	sand	5g/1.0					4.25 gpm
	turbidity 53.3 nTu							stop pumping/recover
1000	begin pumping again dtw 638.50							
	slight color discoloration IMHOF 5 ml/L							
1005	IMHOF parameters: 0.256				6.63	385	17.77	turbidity: 11.8 nTu
1005	shut off pump, dry; start recovery, dtw past sanding tube							
1045	dtw 613.45							
	IMHOF 0 ml/L P: 0.250				6.79	384	19.94	turbidity 29.5 nTu
1050			0.256		7.28	394	20.81	turbidity 16.7 nTu
1115	dtw 605.20							
1150	dtw 593.98							start pumping @ ~2 gpm
1200	dtw 610.43							
	IMHOF 0.1 ml/L P: 0.258				6.40	398	20.37	turbidity 39.7 nTu
Comments:								

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.:
Well No.: <u>NSH-010</u>	Date: <u>3/6/15</u>
Location: <u>NSH-CT</u>	Measuring Point:
Total Depth of Well (ft bls):	Screen Interval (ft bls):
Pump Type/Setting (ft bls):	Activity:
How Q Measured:	H&A Personnel: <u>T. Nelson</u>

total dissolved solids								
Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. <del>F</del> °C	Comments
1215	dtw	626.45	~7.5 gpm					
1230	dtw	635.60	0.256	—	6.45	393	21.78	turbidity 6.30 nTU
1245	dtw	641.63	~2 gpm					
1300	dtw	647.16	0.265	—	6.24	409	20.84	turbidity 7.85 nTU
1320	dtw	653.11	clear					
1340 <del>dtw</del>	dtw	657.15						
1400	dtw	cascading						
1420	~6.28 gpm							
1440	no sand		0.266	—	6.54	409	22.21	turbidity 9.4 nTU
1500	dtw	cascade						stop pumping
1515	dtw	656.51						
1530	dtw	634.10						
1545	dtw	612.67						start pumping @ ~4 gpm
1600	dtw	647.81	0.26	—	6.37	403	21.75	turbidity 9.4 nTU
1615	dtw	657.20	clear		~6 gpm			
1630	dtw	657.30	0.266	—	6.77	409	22.68	turbidity 8.29 nTU
1645	dtw	~657 cascade						STOP PUMP, START RECOVERY
1700	dtw	642.25						
1705	dtw	620.16						
1715	dtw	616.24						transducer SN 391702
1725	dtw	613.56						~650 ft
1735	dtw	612.70						"NSH-010 3-6-15"
1745	dtw	612.34						10 min intervals
1755	dtw	612.08						
1805	dtw	611.85						
1815	dtw	611.72						
1820	place transducer							
1830	off-site							
Comments:								

# Pump DEVELOPMENT FIELD DATA LOG

Page 1 of 2

Project Name: <u>EXLUSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-010</u>	Date: <u>3/5/15</u>
Location: <u>NSH-CT</u>	Measuring Point: <u>TOP OF 1" PVC @ 1.4 ft abo</u>
Total Depth of Well (ft bls):	Screen Interval (ft bls): <u>378-598, 638-698</u>
Pump Type/Setting (ft bls): <u>40S100-30 @ 675'</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>GPI 2" PROPELLER</u>	H&A Personnel: <u>C. GARDNER, T. NELSON</u>

## AND BUCKET TEST

Time	Discharge (gpm)	Pumping Water Level (ft) bms	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1130	0	549.0						STATIC FLUID LEVEL
1145								STARTED PUMPING, FLOW METER NOT WORKING
								DISCHARGE IS DRILLING FLUID, BENTONITE
1200	15	613.3						DRILLING FLUID, HEAVY
1210	0	610.0						STOPPED PUMPING
1220								ADDING WATER FROM TRUCK, ~40 gpm
1300								WATER ADDED TO TOP OF CASING ~1600 g
1305								Started pumping, heavy mud ~345 gpm
								IMHOPE cone, turned cloudy, sand 0.3 ml/L
1315								~40 gpm cloudy water dtw 460 ft
1325								water ~32 gpm 560.50 dtw
1330								dtw 610 ft ~22 gpm mud
1345								pump rest of water ~1000 g while pumping
1400								dtw 622 ft ~23 gpm muddy water
1410								~1 gpm shut off pumping
1435								ADDING WATER FROM TRUCK ~40 gpm
1445								start pumping adding water ~1500 g total
								muddy water ~31 gpm
1450								dtw 539 ft; water
1505								cloudy water ~28 gpm dtw 632
1515								dtw 656.50 Discharge is cloudy water ~23 gpm
1530								dtw <del>656.50</del> 655.80 mud ~1.9 gpm
								Add water from truck
1540								dtw sounder issue
1610								dtw 675.12 start recovery test
1645								dtw 669.34
1670								dtw 669.94
1625								dtw 653.81

Comments:



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-010</u>	Date: <u>3/5/15</u>
Location: <u>NSH-CT</u>	Measuring Point: <u>Top of 1" PVC @ 1.4 ft abs</u>
Total Depth of Well (ft bls):	Screen Interval (ft bls): <u>378-598, 638-648</u>
Pump Type/Setting (ft bls): <u>405100-30 c 675'</u>	Activity: <u>Pump development</u>
How Q Measured: <u>GPI 2" Propeller and</u>	H&A Personnel: <u>C. Gardner, T. Nelson</u>

bucket test

[illegible]

# DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.:
Well No.: NSH-C10	Date: 11/3/14
Location:	Measuring Point:
Total Depth of Well (ft bls): 720	Screen Interval (ft bls):
Pump Type/Setting (ft bls):	Activity: AIRLIFT DEVELOPMENT
How Q Measured:	H&A Personnel: D. ANDERSEN

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. ( $\mu$ mhos/cm)	Temp. °F	Comments
0234				60				Coarse sand = 20.
0246								Shut down + surge
0258								START DEB AIRLIFTING
0300				30				Coarse sand = 10
0305				30				Coarse sand = 5
0310				100				Coarse sand = 10
0315				100				Coarse sand = 15
0320				80				Coarse sand = 10
0325				50				Coarse sand = 12
0325								Surge for 10 min
0340								Begin airlift
0343				25				Coarse sand = 4
0348				80				Coarse sand = 8
0353				200				Coarse sand = 4
0358				120				Coarse sand = 10
0405				75				Coarse sand = 6
0515								At Bit @ 505 DLS Start Air Lift

Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681-205</u>
Well No.: <u>NSH-012</u>	Date: <u>12/22/14</u>
Location: <u>N. of I-10, NR The Thing</u>	Measuring Point: <u>TOP OF MONUMENT</u>
Total Depth of Well (ft bls): <u>501.7'</u>	Screen Interval (ft bls): <u>450-490</u>
Pump Type/Setting (ft bls): <u>NA</u>	Activity: <u>Drilling</u>
How Q Measured: <u>NA</u>	H&A Personnel: <u>GR</u>

[illegible]

Project Name: <u>Excelsior</u>	Project No.:
Well No.: <u>NSH-013</u>	Date: <u>11-7-14</u>
Location: <u>NSH-BW</u>	Measuring Point: <u>Land surface</u>
Total Depth of Well (ft bls): <u>1070'</u>	Screen Interval (ft bls): <u>— open borehole 650'-1070'</u>
Pump Type/Setting (ft bls): <u>air lift w/ bit on bottom</u>	Activity: <u>Rig Development</u>
How Q Measured: <u>visual estimation</u>	H&A Personnel: <u>C. Price</u>

[illegible]

# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38691</u>
Well No.: <u>NSH-013</u>	Date: <u>1-12-15</u>
Location: <u>NSH-BW</u>	Measuring Point: <u>Top of 1" PVC @ 4.46' als</u>
Total Depth of Well (ft bls): <u>1070'</u>	Screen Interval (ft bls): <u>Open 646' - 1070</u>
Pump Type/Setting (ft bls): <u>submersible @ 746.2'</u>	Activity: <u>Pump development</u>
How Q Measured: <u>EM Flow</u>	H&A Personnel: <u>C Price</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1440	0	659.11	-	-	-	-	-	Static water lvl
1454	Pump on pumping @ ~ 20 gpm							
1457	20.54	683.40	0.86	<<0.1	7.2	420	20.1	cloudy w/air → clear has small black strikes.
1503	19.51	689.65	0.64	<<0.1	7.2	390	22.5	clear
1510	18.20	697.75	0.47	<<0.1	7.3	390	22.0	clear
1515	18.06	702.59	0.42	<0.1	7.4	390	22.6	cloudy with air → clear
1521	17.66	707.44	0.37	<<0.1	7.4	380	23.1	clear
1526	17.45	710.11	0.34	<<0.1	7.4	380	23.1	cloudy with air → clear
1530	16.66	712.61	0.31	<<0.1	7.4	390	23.1	cloudy with air → clear
1535	16.84	715.34	0.30	<<0.1	7.5	390	23.5	clear
1542	16.84	718.72	0.28	<<0.1	7.4	386	24.2	clear
1546	16.67	720.43	0.27	<<0.1	7.4	360	24.8	cloudy with air → clear
1550	16.56	722.55	0.26	0	7.4	380	23.7	cloudy with air → clear
1556	16.34	724.45	0.25	0	7.4	380	24.4	cloudy with air → clear
1558	adjusting valve opening 160%							
1600	19.24	727.25	0.28	0	7.4	380	23.9	cloudy with air → clear
1604	18.85	731.22	0.26	0	7.4	390	23.3	cloudy with air → clear
1610	18.50	733.63	0.25	0	7.5	380	23.0	cloudy with air → clear
1616	18.40	736.25	0.24	0	7.4	380	23.5	cloudy with air → clear
1623	18.06	738.85	0.23	0	7.3	380	23.6	cloudy with air → clear
1627	17.96	740.29	0.23	0	7.3	370	24.5	cloudy with air → clear
1634	17.45	742.45	0.20	0	7.3	380	24.0	cloudy with air → clear
1640	17.50	744.30	0.20	0	7.3	360	23.7	cloudy with air → clear
1647	17.22	746.30	0.19	0	7.3	370	24.7	cloudy with air → clear
1654	17.06	746.82	0.19	0	7.3	390	23.4	cloudy with air → clear
1701	16.85	749.05	0.17	0	7.3	370	24.3	
1704	Pump off							

Comments:

67.14

## Page 2 of 2

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# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excursion</u>	Project No.: <u>38601</u>
Well No.: <u>NSH-013</u>	Date: <u>2/22/15</u>
Location: <u>NSH-13W</u>	Measuring Point: <u>top of 1" PVC @ 3.1' abt</u>
Total Depth of Well (ft bls): <u>1070</u>	Screen Interval (ft bls): <u>open @ 50-1070</u>
Pump Type/Setting (ft bls): <u>855200-18 @ 869</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPI PROBELEN 2"</u>	H&A Personnel: <u>C. GARDNER, C. PRICE</u>

Time	Discharge (gpm)	Pumping Water Level (ft) bmp	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1400	656.23	ft bmp						STATIC WATER LEVEL
1401		COMMENCED	PUMPING					at ~20 gpm
1405	20.23	707.33						cloudy w/air → clear 6.02 NTU
1410	20.38	710.36	-	<0.1	-	-	-	cloudy w/air → clear
1415	20.12	720.31	-	<0.1	-	-	-	clear
1420	19.58	722.89	-	0	-	-	-	cloudy w/air → clear
1425	19.42	724.83	-	<0.1	-	-	-	cloudy w/air → clear
1430	19.42	727.43	-	<0.1	-	-	-	cloudy w/air → clear
1435	19.20	730.38	-	<0.1	-	-	-	cloudy w/air → clear
1437		opened	valve					to increase flow to 20.55 gpm
1440	20.62	734.14	-	<0.1	-	-	-	cloudy w/air → clear
1445	20.41	737.92	-	<0.1	-	-	-	cloudy w/air → clear
1445		Pump OFF						
1450	0	692.35	-	-	-	-	-	-
1455	0	679.65	-	-	-	-	-	-
1500	0	182.75						
1500		Turned	pump	on	@			~30 gpm
1505	29.90	737.90	-	<0.1	-	-	-	cloudy w/air → clear
1510	29.42	745.55	-	<0.1	-	-	-	cloudy w/air → clear
1515	28.94	752.56	-	<0.1	-	-	-	cloudy w/air → clear
1520	29.20	758.68	-	<0.1	-	-	-	cloudy w/air → clear
1525	28.63	764.69	-	<0.1	-	-	-	cloudy w/air → clear
1530	29.26	770.30	-	<0.1	-	-	-	cloudy w/air → clear
1535	28.63	774.68	-	<0.1	-	-	-	cloudy w/air → clear
1540	29.58	780.31	-	<0.1	-	-	-	cloudy w/air → clear
1545	29.62	785.25	-		-	-	-	cloudy w/air →
1546		Pump OFF						
1600		Pump	on	@				~40 gpm
Comments:								

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Project Name: <u>Explosion</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-013</u>	Date: <u>2-22-15</u>
Location: <u>NSH-013 BW</u>	Measuring Point: <u>Top of 1" PVC @ 3.1' ALS</u>
Total Depth of Well (ft bls): <u>1070</u>	Screen Interval (ft bls): <u>open 650-1070</u>
Pump Type/Setting (ft bls): <u>855200-15 @ 869</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPI Propeller 2"</u>	H&A Personnel: <u>C Price</u>

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Project Name: EXCURSION	Project No.: 38681
Well No.: NSH-014B	Date: 1-9-15
Location: NSH-DN	Measuring Point: TOP OF CASING GOT TO LAND
Total Depth of Well (ft bls): 1260	Screen Interval (ft bls): 1180-1260
Pump Type/Setting (ft bls): AIRLINE	Activity: AIRLIFT DEVELOPMENT
How Q Measured: VISUAL ESTIMATION	H&A Personnel: C. GARDNER

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# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCAVATION</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-016</u>	Date: <u>1-11-15</u>
Location: <u>NSH-CL</u>	Measuring Point: <u>TOP OF 1" PVC @ 3.57 FT abt</u>
Total Depth of Well (ft bls): <u>820 FT</u>	Screen Interval (ft bls): <u>OPEN 579-820'</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE @ 653'</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>EM FLOW</u>	H&A Personnel: <u>C. GANDER, K. FORD</u>

Time	Discharge (gpm)	Pumping Water Level (ft) bwp	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °C	Comments
1350	0	605.10	-					STATIC WATER LEVEL
1355	STARTED PUMPING @ ~20 GPM							
1400	?	610.55			6.9	580	22.4	CLOUDY (Meter clogged)
1400+	0	SHUT DOWN TO CLEAN FLOW METER						
1407	STARTED PUMPING ~20 GPM							
1410	19.07	607.79	7.1	<<0.1	7.0	590	23.5	CLOUDY, FEW BLACK PARTICLES
1415	HAD TO OPEN VALVE TO FLUSH							
1419	BACK AT ~20 GPM							
1425	20.08	608.20	6.5	<<0.1	7.1	580	23.4	SLIGHTLY CLOUDY, FEW BLACK PARTICLES
1430	20.08	608.23	6.4	<<0.1	7.1	570	23.5	SLIGHTLY CLOUDY TO CLEAR
1440	20.02	608.32	6.2	0.0	7.2	580	23.4	CLEAR
1450	20.14	608.38	6.1	0.0	7.2	580	23.3	CLEAR
1500	20.02	608.43	6.0	0.0	7.2	580	23.3	CLEAR
1502	ADJUST VALVE TO ~30 GPM							
1507	29.88	610.61	5.4	<<0.1	7.2	580	23.6	CLEAR, FEW SAND GRAINS
1512	29.94	610.68	5.4	<<0.1	7.1	570	24.1	CLEAR, FEW SAND GRAINS
1522	29.98	610.76	5.3	<<0.1	7.2	570	23.8	SLIGHTLY CLOUDY WHITE, FEW SAND
1532	29.99	610.88	5.2	<<0.1	7.3	580	23.4	SLIGHTLY CLOUDY WHITE, FEW SAND
1542	30.04	610.98	5.1	<<0.1	7.2	570	23.3	SLIGHTLY CLOUDY → CLEAR, FEW SAND
1552	30.10	611.02	5.1	0.0	7.2	580	23.4	SLIGHTLY CLOUDY → CLEAR, FEW SAND
1602	30.10	611.11	5.0	0.0	7.3	580	23.3	SLIGHTLY CLOUDY → CLEAR
1604	ADJUST VALVE TO MAX							
1609	33.66	612.05	4.8	0.0	7.2	580	23.3	SLIGHTLY CLOUDY → CLEAR
1619	33.82	612.17	4.8	<<0.1	7.2	580	22.9	SLIGHTLY CLOUDY → CLEAR, FEW SAND
1629	33.72	612.26	4.7	0.0	7.2	580	23.1	CLEAR
1639	33.88	612.31	4.7	<<0.1	7.2	570	23.0	CLEAR, FEW SAND GRAINS
1641	0	RECOVER ~10 MINS						
1653	START PUMPING AT MAX							
1658	34.10	611.88	5.1	0.1	7.2	580	22.5	SLIGHTLY CLOUDY, SOME SAND
Comments:								
1708	33.88	612.08	4.8	<<0.1	7.2	580	22.5	SLIGHTLY CLOUDY, FEW SAND GRAINS TO CLEAR.
1715	33.72	612.18	4.8	<<0.1	7.2	580	22.6	SLIGHTLY CLOUDY TO CLEAR, FEW SAND GRAINS

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-017</u>	Date: <u>1-6-15</u> <u>2:47</u>
Location: <u>NSH-CK</u>	Measuring Point: <u>TOP OF 1" PVC, 2.47' stick up</u>
Total Depth of Well (ft bls): <u>1200</u>	Screen Interval (ft bls): <u>940-1180 ft</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE 926 bls</u>	Activity: <u>PUMP + SURGE</u>
How Q Measured: <u>GPI FLOW METER</u>	H&A Personnel: <u>KENDRA FORD</u>

Time	Discharge (gpm)	Pumping Water Level (ft) BMP	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F °C	Comments
1800	0	598.30						STATIC WATER LEVEL
0600	0	598.34						STATIC WATER LEVEL
0610	STARTED PUMPING, ADJUST VALVE							
0614	5.24	601.24	1.8	<<0.1	7.5	350	20.4	CLOUDY, GREYISH-WHITE (AIR)
0620	5.42	601.13	1.9	<<0.1	7.3	370	22.6	CLOUDY, GREY <del>WATER</del>
0625	5.42	601.15	1.9	<<0.1	7.2	450	22.8	CLOUDY, GREY
0630	5.47	601.14	2.0	<<0.1	7.2	470	23.1	CLOUDY, GREY
0635	5.52	601.16	2.0	<0.1	7.2	480	22.6	CLOUDY, GREY
0640	5.52	601.15	2.0	<0.1	7.3	480	22.6	CLOUDY GREY
0646	ADJUST VALVE TO ~10 GPM							
0648	0							
0700	STARTED PUMPING							
0705	10.44	603.42	2.1	0.1	7.3	480	21.6	CLOUDY, GREY, SOME BLACK PARTICLES
0710	10.50	603.35	2.1	<0.1	7.3	480	23.1	CLOUDY, GREYISH BROWN
0715	10.50	603.37	2.1	<0.1	7.2	470	24.3	CLOUDY → CLEAR
0720	10.44	603.41	2.1	<<0.1	7.2	470	24.7	SLIGHTLY CLOUDY → CLEAR
0725	10.38	603.38	2.1	<<0.1	7.3	490	24.3	SLIGHTLY CLOUDY → CLEAR
0730	10.44	603.37	2.1	<<0.1	7.3	500	24.4	SLIGHTLY CLOUDY → CLEAR
0733	ADJUST VALVE TO ~15 GPM							
0734	0							
0750	STARTED PUMPING							
0755	15.00	605.56	2.1	<0.1	7.3	460	23.8	CLOUDY, GREYISH BROWN, A FEW BLACK PARTICLES
0800	15.00	605.58	2.1	<0.1	7.2	480	25.2	SLIGHTLY CLOUDY → CLEAR
0805	15.00	605.66	2.0	<0.1	7.2	470	25.4	CLEAR
0810	15.00	605.72	2.0	<<0.1	7.2	480	25.6	CLEAR
0816	15.00	605.77	2.0	<<0.1	7.2	480	26.0	CLEAR
0820	15.00	605.67	2.0	<<0.1	7.2	480	25.9	CLEAR
0824	ADJUST VALVE TO ~20 GPM							
Comments:								

# DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.: 38681
Well No.: NSH-017	Date: 1-7-15
Location:	Measuring Point: TOP OF 1" PVC PIPE, 3.47' Skidup
Total Depth of Well (ft bls): <del>1180</del> 1200	Screen Interval (ft bls): 940 - 1180
Pump Type/Setting (ft bls): SUBMERSIBLE / 926 bls	Activity: PUMP + SURGE
How Q Measured: GPI FLOW METER	H&A Personnel: KENDRA FORD
STATIC = 598.34	

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Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.: 38681
Well No.: NSH-017	Date: 1-7-15
Location:	Measuring Point: TOP OF 1" PVC PIPE, 3.45 ft sidewalk
Total Depth of Well (ft bls): 1200	Screen Interval (ft bls): 940 - 1180
Pump Type/Setting (ft bls): SUBMERSIBLE / 713 bls	Activity: PUMP + SURGE
How Q Measured: GPI FLOW METER	H&A Personnel: KENDRA FORD

STATIC = 598.34

Time	Discharge (gpm)	Pumping Water Level (ft) BMP	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F °C	Comments
1118	0	604.65						
1120	START PUMPING		MAX					
1125	32.54	620.74	1.5	<0.1	7.7	300	26.5	SLIGHTLY CLOUDY GREY
1130	32.54	621.22	1.4	<0.1	7.6	440	26.6	SLIGHTLY CLOUDY GREY
1135	32.44	621.63	1.4	<0.1	7.4	490	26.5	CLEAR
1140	32.49	621.84	1.4	0	7.3	490	26.5	CLEAR
1144	STOP PUMPING		RECHARGE					
1230	0	605.32						
1233	START PUMPING		ADJUST VALVE	10 GPM				
1238	10.06	610.07	0.9	<0.1	7.0	470	25.7	SLIGHTLY CLOUDY GREY → CLEAR
1250	10.06	610.09	0.9	<0.1	7.2	500	25.7	CLEAR
1300	10.11	610.19	0.9	0	7.2	490	26.2	CLEAR
1310	10.11	610.31	0.8	0	7.2	500	26.5	CLEAR
1320	10.11	610.40	0.8	<0.1	7.3	490	26.5	CLEAR
	ADJUST VALVE TO	20 GPM						
1325	20.36	615.35	1.2	0	7.2	490	26.8	CLEAR
1335	20.30	615.73	1.2	0	7.2	500	26.4	CLEAR
1345	20.41	615.96	1.2	0	7.3	500	26.5	CLEAR
1355	20.36	616.14	1.1	0	7.3	510	26.5	CLEAR
1405	20.30	616.32	1.1	0	7.3	490	26.3	CLEAR
	ADJUST VALVE TO	MAX	~32 GPM					
1410	31.54	622.28	1.3	0	7.3	500	26.1	CLEAR
1420	31.44	622.73	1.3	0	7.3	500	26.2	CLEAR
1430	31.49	623.08	1.3	0	7.2	500	26.3	CLEAR
1440	31.60	623.23	1.3	0	7.3	500	26.4	CLEAR
1450	31.49	623.36	1.3	0	7.3	520	25.7	CLEAR
	STOP PUMPING							
Comments:								



# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCLUSION</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-017</u>	Date: <u>1-27-15</u>
Location: <u>NSH-CK</u>	Measuring Point: <u>TOP OF 1" PVC @ 3.24 FRA</u>
Total Depth of Well (ft bls): <u>1181</u>	Screen Interval (ft bls): <u>940-1181</u>
Pump Type/Setting (ft bls): <u>GRUNDFOS / 931</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>EM FLOW METERS</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft) bwp	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. (°F / °C)	Comments
1513	0	598.22	TOTALizer @ 0.0					STATIC WATER LEVEL
1515	STARTED PUMPING ~40 gpm							
1519	82.58	655.00	-	0.1	6.85	451	21.1	TURBID GREEN w/ BL P
1520	80.72	654.67	-	0.25	6.80	466	21.3	TURBID BROWN
1522	81.36	655.20	-	0	6.91	499	22.8	TURBID-CLOUDY, NTU=182
1526	80.40	656.35	1.4	0	6.97	507	23.4	CLOUDY-CLEAR, NTU=42.9
1531	86.04	657.09	1.4	0	7.00	507	23.5	CLEAR, NTU=11.4
1536	80.88	657.84	1.4	0	7.09	504	23.2	CLEAR, NTU=11.4
1541	80.72	658.14	1.3	0	7.10	508	23.6	CLEAR, NTU=14.8
1546	80.88	658.44	1.3	0	7.09	508	23.6	CLEAR, NTU=7.20
1551	80.88	658.80	1.3	0	7.07	505	23.4	CLEAR, NTU=5.45
1556	81.04	659.14	1.3	0	7.06	500	22.7	CLEAR, NTU=5.70
1601	81.82	659.35	-	-	-	-	-	-
1610	81.20	659.80	-	-	-	-	-	-
1620	82.28	660.08	-	-	-	-	-	-
1626	80.88	660.31	1.3	0	7.08	505	23.4	CLEAR, NTU=3.83
1640	80.88	660.74	-	-	-	-	-	-
1650	80.88	661.02	-	-	-	-	-	-
1700	81.38	661.18	1.3	0	7.07	504	23.7	CLEAR, NTU=2.35
1715	80.72	661.45	1.3	0	7.07	502	23.1	CLEAR, NTU=2.76
1740	81.36	662.03	-	-	-	-	-	-
1750	80.88	662.15	1.3	0	7.09	502	22.7	CLEAR, NTU=3.41
1800	81.82	662.28	-	-	-	-	-	-
1800+	SHUTTING DOWN							
1802	0	593.00						
1804	0	591.65						
1808	0	598.00						
1810	0	603.10						

Comments: DTW FR bwp  
NSH-015    NSH-016    DRAWDOWN    1/28/15 @ NSH-017  
 1330    600.90    604.72    0    DTW 598.48 FR bwp @ 1013  
 1335    -    604.71    0    1/28/15 @ NSH-015  
 1615    -    604.71    0    DTW 601.00 FR bwp @ 1016  
 1623    602.64    -    1.74'    DTW 601.00 FR bwp @ 1016  
 1654    602.75    -    -    -  
 1723    602.83    -    -    -  
 1742    602.88    -    -    -

PUMPING

STOPPED

PUMPING

K:\Templates\Field Forms\Well Inst & Testing Forms.xls

1806    601.86    601.86  
 1823    601.46    601.46

HALEY & ALDRICH

# Pump DEVELOPMENT FIELD DATA LOG

Page 1 of 2

Project Name: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-018</u>	Date: <u>1-9-15</u>
Location: <u>NSH CV</u>	Measuring Point: <u>3.38 Ft above surface</u>
Total Depth of Well (ft bls): <u>997</u>	Screen Interval (ft bls): <u>610 - 990</u>
Pump Type/Setting (ft bls): <u><del>700</del> SUBMERSIBLE / 700</u>	Activity: <u>(PSEUDO) STEP TEST</u>
How Q Measured: <u>GPI METER</u>	H&A Personnel: <u>KENDRA FORD</u>

Time	Discharge (gpm)	Pumping Water Level (ft) BMP	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F °C	Comments
1303	0	594.80						STATIC
1307	START PUMPING, ADJUST FLOW TO ~ 20 GPM							
1313	21.42	597.22	8.9	<0.1	7.6	430	22.3	SLIGHTLY CLOUDY - CLEAR, BROWNISH
1318	19.34	596.92	9.1	<0.1	7.3	390	23.7	"
1323	19.34	596.88	9.3	<0.1	7.3	320	24.1	CLEAR (WHITE AIR)
1328	18.90	596.80	9.5	<0.1	7.4	400	23.6	CLEAR
1333	18.90	596.81	9.4	<0.1	7.3	390	24.2	CLEAR
1339	18.80	596.78	9.5	<<0.1	7.3	380	24.1	CLEAR
1348	HAD TO OPEN VALVE TO FLUSH - EQUALIZER NOT WORKING							
1350	19.57	597.00	8.9	<0.1	7.3	410	24.2	CLEAR
1400	17.11	596.70	9.0	<0.1	7.2	370	24.9	CLEAR
1405	16.28	596.44	9.9	0.1	7.3	380	24.6	CLEAR
1415	15.72	596.38	9.9	<0.1	7.3	360	24.8	CLEAR
1425	15.67	596.32	10.3	<0.1	7.3	370	24.3	CLEAR
1435	15.45	596.34	10.0	<0.1	7.2	400	24.9	CLEAR
1436	ADJUST VALVE TO ~ 30 GPM							
1440	30.66	598.81	7.6	0.1	7.3	370	24.8	CLEAR
1446	HAD TO OPEN VALVE TO FLUSH -							
1447	30.04	599.40	6.5	<0.1	7.2	360	24.9	CLEAR
1452	29.66	599.04	7.0	<0.1	7.2	380	25.2	CLEAR
1457	29.26	599.04	6.9	<0.1	7.3	380	24.4	CLEAR
1502	29.32	599.14	6.8	<0.1	7.2	370	25.2	CLEAR
1507	29.21	599.14	6.7	<0.1	7.2	370	25.2	CLEAR
1512	29.21	599.12	6.8	<0.1	7.2	380	25.2	CLEAR
1522	HAD TO OPEN VALVE							
1538	30.38	599.61	6.3	<0.1	7.3	390	23.9	CLEAR
1548	30.21	599.58	6.3	<0.1	7.2	390	24.5	CLEAR
1558	29.99	599.55	6.3	<0.1	7.3	400		CLEAR

Comments:



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STATIC: 594.80

Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>ENCE/4.0W - GUNNISON</u>	Project No.: <u>38681-205</u>
Well No.: <u>15H-018</u>	Date: <u>12/20/14</u>
Location: <u>S. OF I-10 @ THE THING</u>	Measuring Point: <u>TOP OF STEEL 1.1' ALS</u>
Total Depth of Well (ft bls):	Screen Interval (ft bls):
Pump Type/Setting (ft bls): <u>656/4" GMB</u>	Activity:
How Q Measured: <u>5 GAL Bucket</u>	H&A Personnel:

TDS

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1634	20	UTM						
1710	30							
0800	0.0							
1010	OFF							
1109	-		190		7.8	410	15.4	MOVIES PARAMS MEAS. AFTER THE COLLECTION. KIT WAS NOT ON SITE
1215	OFF							
140	ON							
1200	OFF							
1215	ON							
1220	OFF							
1230	ON							
1236	OFF							
1241	ON							
1246	OFF							
1251	ON			3.0 FINES				APPEARS TO BE RED ALGAE
1256	OFF							
1302	ON			5.0				
1307	OFF							
1312	ON			2.0				
1317	OFF							
1330	ON							
1335	OFF							
1340	ON			0.5				
1345	OFF							
1350	ON							
1355	OFF							
POM Pump								
Comments:								

## Page 1 of 1

[illegible]

# Pump DEVELOPMENT FIELD DATA LOG

Page 1 of 2

Project Name: <u>EXPLOR</u>	Project No.: <u>39601</u>
Well No.: <u>NSH-020</u>	Date: <u>1-8-15</u>
Location: <u>NSH-CX</u>	Measuring Point: <u>TOP OF 1" PVC @ 3.4 ft stickup</u>
Total Depth of Well (ft bls): <u>1582</u>	Screen Interval (ft bls): <u>1000-1582, 3 INTERVALS</u>
Pump Type/Setting (ft bls): <u>SUMMIT 700'</u>	Activity: <u>PUMP AND SAMPLE</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft) WMP	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F / °C	Comments
1100	0	607.55						STATIC WATER LEVEL
1116	STARTS PUMPING FINE BLACK PARTICLES							
1120	3.60	608.3		40.1	8.0	260	18.8	TURBID / MUY W/ AIR
1127	0	606.1		clean 0.0	8.4	230	21.1	SPRINGS TO CLOUDY GRAY
1128	OPEN VALVE 100% VISUAL ~ 5 gpm							
1128	SHUT DOWN							
	CHECKS ELECTRICAL PANEL LOWV. → GOOD							
1140	PUMPING VALVE 100% OPEN							
1144	ZERO DISCHARGE. SHUT OFF							
1148	PUMPING ~ 30 gpm 4 gpm ADJUSTED TO 10							
								FINE BLACK PARTICLES
1150	12.43	609.8		40.1	8.8	230	22.2	TURBID GRAY → CLOUDY GRAY
1153	DISCHARGE RATE DROPPING TO < 0.1 gpm							
1155	SHUT OFF							
1159	PUMPING, VALVE 100% OPEN ~ 33 gpm, MAKING FINE TO MEDIUM SAND-SIZED BLACK PARTICLES WHICH APPEAR TO BE FLOCCULATING. MAY HAVE CAUSED PUMP ISSUES @ LOW RATES							
1204	612.9	33.55		< 0.1	8.5	450	21.8	TURBID, LIGHT BROWN, FLOCCULATES w/ TIME @ 4 mL
1209	36.00							
1209	613.2	36.63.2	6.4	0.0	8.2	520	22.8	TURBID TO CLOUDY LT. BROWN
1215	36.00	613.3	6.3	0.0	7.7	430	25.0	CLOUDY, LT BROWN
1221	36.06	613.40	6.2	0.0	7.5	430	25.4	CLOUDY w/ AIR RINGS CLOUDY TO
1230	35.66	613.42			7.3	430		ARM, LIGHT BROWN
1230	35.66	613.42	6.1	0.0	7.3	430	24.7	CLOUDY w/ AIR → CLOUDY-CLEAR
1237	35.66	613.46	6.0	0.0	7.4	430	23.6	" " "
Comments:								

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# AIRLIFT DEVELOPMENT FIELD DATA LOG

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Project Name: <u>GREYSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-021C</u>	Date: <u>1-30-15</u>
Location: <u>NSH-DB</u>	Measuring Point: <u>-</u>
Total Depth of Well (ft bls): <u>1404, BUT TO 1372</u>	Screen Interval (ft bls): <u>OPEN 623-1372'</u>
Pump Type/Setting (ft bls): <u>AIRLIFT, VARIOUS</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>VISUAL ESTIMATE</u>	H&A Personnel: <u>C. GANDNON</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
1425	~25	STARTED	AIRLIFT	FROM ~900 FEET	20.1	SANDY	188	NTU
1435	~25	-	-	0.4	FN-MED SIZED PARTICLES	TURBID	401	NTU
1440	~25	-	-	0.1	"	CLOUDY	81.6	NTU
1445	~25	-	-	0.2	FN-LAS SAND SIZED PARTICLES	CLOUDY-CLEAN	32.3	NTU
1450	~25	-	-	0.1	FN-MED SAND SIZED PARTICLES	CLEAN	24.2	NTU
1450+	0	SURGE RECOVER	TOTAL	CHURNING - 0.04 mg/L	NO OIL? LUBASE	0.04 mg/L		CE-1
1500	~35	STARTED	AIRLIFT	0.1	FINE SAND-SIZED PARTICLES	CLOUDY-CLEAN	35.1	NTU
1510	~35	-	-	20.1		CLOUDY-CLEAN	37.4	NTU
1515	~35	-	-	20.1	FN-MED SIZED PARTICLES	CLEAN	23.0	NTU
1520	~35	-	-	20.1	7.63	428	20.1	CLEAR, 16.9 NTU
1520+	STOPPED	AIRLIFT, INSTALLING AIRLINE TO ~1000 FEET						
1550	~75	FINE-MED SAND FINE GRAVEL	0.2	CLOUDY TO CLEAR	63.8	NTU		
		ABRILCO (WHITE + GREEN)						
1555	~75	"	-	0.1	-	-	CLEAR	20.5 NTU
1600	~75	"	-	20.1	-	-	CLEAN	14.2 NTU
1610	~75	FINE SAND-SIZED PARTICLES	20.1	-	-	-	CLEAN	10.3 NTU
1610+	0	SURGE RECOVER						
1620	~75	STARTED	AIRLIFT					
1630	~75	FINE-MED SAND CLOUDY	0.1	-	-	-	CLEAR	22.7 NTU
1640	~75	FINE SAND-SIZED	20.1	-	-	-	CLEAN	10.0 NTU
1650	~75	FINE SAND-SIZED	20.1	7.32	429	20.3	CLEAN	7.8 NTU
1650+	0	SURGE RECOVER						
1700	~75	STARTED	AIRLIFT					
1705	~75	-	-	20.1	-	-	-	CLEAN, 15.7 NTU
1715	~75	-	-	20.1	-	-	-	CLEAN 8.32 NTU
1725	~75	-	-	20.1	-	-	-	CLEAN, 6.79 NTU
1727	SHUT	DOWN	AIRLIFT					

Comments:

## Page 1 of 1

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. ( $\mu$ mhos/cm)	Temp. °F	Comments
1435		Tremie @ 602'						Pumped head of mud out +
		then no						water production.
1515		Tremie @ 800'						Pumped head of mud +
		then ~ 5 gpm						of water, Turbid.
1530	~1 gpm							
1540	0	INSTALLING TREMIE TO ~1000 FEET.						
1-21-15								
0900 ~2		STARTED AIRLIFT FROM ~1000 FEET						
0945 0		SURGE RECOVERY						
1000 ~1		TURBID		<0.1				TURBID, BROWN
1045 0				<0.1				TURBID, BROWN
1100 ~1				40.1				TURBID, BROWN
1145 0								
1200 ~1				40.1				TURBID, BROWN
1300 0		SHUT DOWN, ROLLING AIRLINE						

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# DEVELOPMENT FIELD DATA LOG

Project Name: <i>Exelsior</i>	Project No.: <i>38681</i>
Well No.: <i>NSH-22</i>	Date: <i>1-22</i>
Location: <i>Colusa County</i>	Measuring Point: <i>Top of sanding tube, 1.5' ab</i>
Total Depth of Well (ft bls): <i>1130</i>	Screen Interval (ft bls):
Pump Type/Setting (ft bls): <i>Grndf</i>	Activity: <i>Pump development</i>
How Q Measured: <i>GPI Flow Meter</i>	H&A Personnel: <i>J Cook</i>

[illegible]

# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-022</u>	Date: <u>1-23-15</u>
Location: <u>Cochise County</u>	Measuring Point: <u>Top of sounding tube, 1.5' ab</u>
Total Depth of Well (ft bls): <u>1130</u>	Screen Interval (ft bls): <u>1010 - 1130</u>
Pump Type/Setting (ft bls): <u>4" Grundfos - 900'</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>GPI Flow Meter</u>	H&A Personnel: <u>J Cook</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
0645	0	651.35						Recovered Water Level
0645+	19.62			DK, Brown, turbid, Some sand settle out.				Begin Pumping
0745	~1	868.55		Brown, turbid, less fine material				
0745+	0							Pump off
0845	6.42	773.72		0.4 m% Fine, lighter color, turbid				Begin Pumping
0915	~1			Tan / light Brown, turbid				continue Pumping
0920		867.71						"
0930	1.25							Gallon Bucket Flow Rate
0945	~1			light Brown, turbid				continue pumping
0950	~1	868.83						continue pumping
0955	~1			Water color is becoming lighter				"
1040	~1	868.59		color continuing to clear up				"
1110	~1	867.95						"
1130	~1	867.75						"
1155	1							Gallon Bucket Flow Rate
1230	1	867.60						continue pumping
1250	1	866.10						
1250+	0							Stop Pumping
1255	0	816.0						Recovery
1300	0	798.85						
1305	0	796.60						
1310	0	792.89						
1315	0	790.23						
1320	0	788.35						
1320+								Trip out Pump

Comments: Pump Development.

Project Name: <u>Excavator</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-022</u>	Date: <u>1-23-15</u>
Location: <u>NSH-BF</u>	Measuring Point: <u>TOP OF SOUNDING TUBE, 1.5' ab</u>
Total Depth of Well (ft bls): <u>1130</u>	Screen Interval (ft bls): <u>See: 1010-1130'</u>
Pump Type/Setting (ft bls): <u>-</u>	Activity: <u>SWAB DEVELOPMENT</u>
How Q Measured: <u>-</u>	H&A Personnel: <u>K. Ford</u>

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## Page 1 of 1

Project Name: EXCELSION	Project No.: 38681
Well No.: NSH-022	Date: 1-24-15; 1-25-15
Location: NSH-BF	Measuring Point: TOP OF SOUNDING TUBE @ 1.5' ab
Total Depth of Well (ft bls): 1130	Screen Interval (ft bls): 1010-1130'
Pump Type/Setting (ft bls): GRUNDIGS @ ~900'	Activity: PUMP DEVELOPMENT & SWAB
How Q Measured: TIME TO FILL BUCKET	H&A Personnel: J. COOK, C. GARDNER

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific DRAWDOWN (ft/gpm)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F °C	Comments
~0615	STARTED		SWABING					
~0815	STOPPED		SWABING					INSTALLING PUMP
1300	STARTED		PUMPING					TURBID BLACK DISCHARGE WITH ODOR OF POLYMER, TURNS BROWN, TURBID.
1353	~1	854.1						TURBID GREENISH BROWN
1500	~1	-						TURBID, GRAY w/ ~30ml/L GRAY FINES
1550	~1	-						TURBID TO CLOUDY <0.5ml/L FINES
1630	~1	869.2						TURBID TO CLOUDY, BROWN <0.2ml/L FINES
1630	————→		248	<0.2	6.8	387 490	14.7	
1740	~1	865.4	244	<0.2	-	-	-	TURBID TO CLOUDY
1745	0							SHUT DOWN FOR THE DAY
1700	~1	867.8	246	<0.2	7.3	467	19.5	

## Comments:

STATIC WATER LEVEL - 621 FT b.m.D

PIPES NOT FULL OF WATER SO FLOW MEASUREMENTS ZERO

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Exdgor</u>	Project No.: <u>38651</u>
Well No.: <u>NSH-022</u>	Date: <u>1-25-15</u>
Location: <u>NSH-BF</u>	Measuring Point: <u>Top of sounding tube ~1.5' abd</u>
Total Depth of Well (ft bls): <u>1130</u>	Screen Interval (ft bls): <u>1130-1010</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE TO 900'</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>Time to Fill Bucket</u>	H&A Personnel: <u>J Cook, C Gardner</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Draw Down (ft/gpm)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
0600	26	628	4 1/2		Turbid	Dark Brown		Begin Pumping
					9.3	318		
0900	~1	868.9	241	20.2	Turbid	Brown, lighter		continue pumping
					8.2	391		
1000	~1			20.2	Turbid	Brown		continue pumping
					8.15	402		
1100	~1			20.2	Turbid	Brown, lighter		continue pumping
					8.2	417		
1200	~1	867.9	240	20.2	Turbid	Brown		continue pumping
					7.43	425	19	
1300	~1	867.7	240	20.2	Turbid	Brown		continue pumping
					6.19	481	22.1	
1400	~1	866.85	239	20.2	Turbid	Brown		continue pumping
					8.24	482	22.8	
1500	~1	866.90	239	20.2	turbid brown			continue pump
					7.0	375		
1600	~1	NA		20.2	light tan			continue pumping
					7.77	337		
1700	~1	-		20.1	TURBID TO CLOUDY, NO FINES			
1800	0	STOPPED PUMPING						

Comments: Static ~ 621' BMP, Flow meter Reads 0 due to low flow

# PUMPING TEST FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-022</u>	Test Start Date & Time: <u>1-26-15 @ 0600</u>
Static Water Level (ft bmp): <u>640.20</u>	Measuring Point: <u>TOP OF 1" PVC, 1.5' abv</u>
Total Depth of Well (ft bls): <u>1130</u>	Screen Interval (ft bls): <u>1010 - 1130'</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE @ 900'</u>	Pump Contractor: <u>NATIONAL</u>
How Q Measured: <u>EM FLOW METER AND TIME TO FILL BUCKET</u>	H&A Personnel: <u>C. GARDNER</u>

Date & Time	Totalizer (gals)	Discharge (instant., gpm)	Pumping Water Level (feet, bmp)	Conductivity ( $\mu$ S/cm)	pH	Temp	Comments
0600	0	0	640.20				STATIC WATER LEVEL
0600+	STARTED PUMPING VALVE WIDE OPEN						
0600.2	21.5	21.54	-	-	-	-	→ 30 mL/L FINES
0604	-	18.80	721.6	257	8.91	19.9	TURBID-CLOUDY
0605	-	17.28	743.0	387	7.95	19.9	CLOUDY, 0 mL/L
0608	-	14.36	773.75	387	7.57	19.9	CLOUDY, 0 mL/L
0608	ADD VALVE TO ~2 gpm						
0611	-	-	779.2	-	-	-	
0615	-	1.16	785.9	402	7.84	21.0	CLOUDY-CLEAN
0616	123.76						
0620		0.33	795.0	396	7.88	20.9	CLOUDY-CLEAN,
0621:30	127.00	→ EM FLOW METER NOT WORKING - LOW RATE 69.4 NTU					
0625	-	0.33	801	399	7.87	21.4	CLOUDY-CLEAR 54.3
0626	-	~2.5 gpm ~1 BUCKET, EM TOO LOW					
0630	-	~2.0	810.22	408	8.01	21.9	CLOUDY-CLEAR 55.8
0635	-	~2.0	816.65	401	8.04	21.1	CLOUDY-CLEAR 54.3 NTU
0640	-	~2.0	822.0	404	8.05	21.6	CLOUDY-CLEAR 53.1 NTU
0645	-	~2.0	827.9	405	8.09	21.6	48.1 NTU
0650	-	~2.0	830.83334	400	8.07	21.5	49.7 NTU
0700	-	~1.5	841.54	398	8.10	20.8	48.1 NTU
0715	-	~1.1	850.20	399	8.14	21.1	46.1 NTU
0720	-	~1.1	852.92	399	8.14	21.0	42.8 NTU
0730	-	~1.0	856.57	396	8.15	20.7	41.1 NTU
0740	-	~1.0	859.46	397	8.15	20.7	39.2 NTU
0750	-	~1.0	862.07	392	8.19	20.5	38.7 NTU
0802	-	~1.0	864.11	-	-	-	-

## Additional Comments:

CRAN PULLING NSH-022 @ ~860 - 900'

0810 TO NSH-022 @ ~905', TRIPPING OUT



# PUMPING TEST FIELD DATA LOG

Well No.: NSH-022	Static Water Level (ft bmp): 640.20
Pump Contractor Personnel: GUY	H&A Personnel: F. GANDNER

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# AIRLIFT DEVELOPMENT FIELD DATA LOG

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Project Name: <u>NSH EXCELSIOR</u>	Project No.: <u>39681</u>
Well No.: <u>NSH-023</u>	Date: <u>2-3-15</u>
Location: <u>NSH-DD</u>	Measuring Point: <u>-</u>
Total Depth of Well (ft bls): <u>1440</u>	Screen Interval (ft bls): <u>OPEN 640-1440</u>
Pump Type/Setting (ft bls): <u>AIRLINE, VARIOUS</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>VISUAL ESTIMATION</u>	H&A Personnel: <u>-</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °C	Comments
1050	STARTED							AIRLIFTING FROM ~900 FEET
1052	~10	-						TURBID BROWN, ~0.5 ml/L SAND & GRAVEL
1055	~10	-						TURBID BROWN, ~0.5 ml/L SAND, ~1.0 ml/L GRAVEL, AFRIGO
1100	~10	-						TURBID BROWN, ~0.3 ml/L FINE-MEDIUM SAND
1110	~10	-		0.2				TURBID BROWN, 542 NTU
1130	~10	-		<0.1				TURBID TO CLOUDY 205 NTU
1145	~10	-		<0.1	7.70	384	22.8	CLOUDY, 109 NTU
1145+	0							SHUT DOWN AIRLIFT, RECOVERY SURGE
1205	STARTED							AIRLIFT FROM ~800
1210	~10	-		<0.1	7.92	381	22.5	CLOUDY, 78.1 NTU
1220	~10	-		<0.1	7.99	382	22.7	CLOUDY, 73.7 NTU
1226+	0							SHUT OFF AIRLIFT, INSTALLING AIRLINE TO 900'
1245	STARTED							TO AIRLIFT FROM ~900 FEET
1250	~25	-		FINE SAND 0.1	7.93	368	22.6	CLOUDY, 90.8 NTU
1300	~25	-		FINE SAND 0.1	7.94	363	23.3	CLOUDY, 113 NTU
1315	~25	-		<0.1	7.94	351	22.9	CLOUDY-CLEAR, 48.2 NTU
1320	0							LOWERING AIRLINE TO ~1000 FEET.
1345	AIRLIFTING							FROM ~1000 FEET
1350	~30	-		<0.1	7.86	340	21.2	CLOUDY-CLEAR, 27.1 NTU
1400	~30	-		FINE SAND 0.9	7.94	321	22.0	TURBID, 858 NTU
1445	~30	-		FINE SAND 0.8	7.95	353	21.6	TURBID-CLOUDY, 194 NTU
1510	~30	-		FINE SAND 0.2	8.0	360	22.0	TURBID-CLOUDY, 169 NTU
1510+	0							SHUT DOWN FOR SURGE RECOVERY
1520	STARTED							AIRLIFT FROM ~1000 FEET - TURBID TO CLOUDY, 178 NTU
1545	~30	FE-OK		FINE SAND 0.4	7.96	370	22.0	TURBID-CLOUDY, 178 NTU
1600	~30	FE-OK		FINE SAND 0.5	8.03	375	23.0	TURBID-CLOUDY, 168 NTU
1615	~30	FE-OK		FINE SAND 0.5	8.02	378	22.8	TURBID-CLOUDY, 181 NTU
1630	~30	FE-OK		FINE SAND 0.3	8.03	380	23.3	TURBID-CLOUDY, 111 NTU
1650	~30	FE-OK		FINE SAND 0.3	8.03	379	22.5	TURBID-CLOUDY, 131 NTU
Comments: MAJOR WASHOUT 900 to 909 FEET, ~971 to 973'								
1700	~30	FE-OK		SAND, FINE 0.4	8.05	377	22.4	TURBID-CLOUDY, 101 NTU



# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-023</u>	Date: <u>1-21-15</u>
Location: <u>NSH-DD</u>	Measuring Point: <u>TOP OF 1" PVC ~1.04' abt</u>
Total Depth of Well (ft bls): <u>1446</u>	Screen Interval (ft bls): <u>OPEN 646-1446</u>
Pump Type/Setting (ft bls): <u>SUBMERSIBLE, ~900</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>GPI FLOW METER</u>	H&A Personnel: <u>C. PRICE</u>

Time	Discharge (gpm)	Pumping Water Level (ft) <u>BMP</u>	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
0615	—	627.35						STATIC WATER LEVEL
0634	—	633.45						
0641	18.06	646.4						
0642	11.46	652.05						
0643	8.5	653.1						
0644	9.89	653.9						
0645	~9	655.1						
0655	~18	675.25						clearing out flow meter
0701	9	673.4						
0735	18.3	728	0.17					
0757	17.5	736.45				Pump OFF		Still has foam, DS=109.1'
0828	Recovery	658						
0844	Recovery	648.5				Pump ON.		
0855	9.89	677.60						10 mins
0905	8.56	680.35						20 mins
0915	7.34	680.50						
0925	7.12	679.0						
0935	6.85	678.12						
0945	6.68	677.09						
0955	18.34	702.87						
1005	17.06	717.74						Clear, Some Foam.
1015	16.56	724.62						
1025	16.34	729.08						
1035	16.00	732.22						
1045	15.84	734.24						
1055	17.00	739.56						
1105	16.78	742.11						
1115	16.62	743.93						
Comments:								

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Project Name: <i>Exide 1</i>	Project No.: <i>38631</i>
Well No.: <i>NSH-023</i>	Date: <i>1-21-15</i>
Location: <i>NSH-DD</i>	Measuring Point: <i>TOP OF 1" PVC ~1.04' als</i>
Total Depth of Well (ft bls): <i>1446</i>	Screen Interval (ft bls): <i>OPEN 646-1446</i>
Pump Type/Setting (ft bls): <i>SUBMERSIBLE, ~900</i>	Activity: <i>PUMP DEVELOPMENT</i>
How Q Measured: <i>GPI FLOW METER</i>	H&A Personnel: <i>C. PRICE</i>

[illegible]

# AIRLIFT DEVELOPMENT FIELD DATA LOG

Page 1 of 2

Project Name: <u>EXCESSIDE</u>	Project No.: <u>36861</u>
Well No.: <u>NSH-024</u>	Date: <u>2-2-2015</u>
Location: <u>NSH-DC</u>	Measuring Point: <u>-</u>
Total Depth of Well (ft bls): <u>1440</u>	Screen Interval (ft bls): <u>OPEN 625-1440'</u>
Pump Type/Setting (ft bls): <u>AIRLIFT VARIOUS</u>	Activity: <u>AIRLIFT DEVELOPMENT</u>
How Q Measured: <u>VISUAL ESTIMATE</u>	H&A Personnel: <u>C. GANNON</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content mL (ppm)	pH	Sp. Cond. (μmhos/cm)	Temp. °F	Comments
1305	~10	STARTED	AIRLIFT	FROM ~800', TURBID				BROWN-CLOUDY
		-	-	0.2 mL/L SAND (MED-FINE), 0.2 mL/L GRAVEL				ABRIL 60, GREEN
		-	-	190 NTU TURBIDITY				
1310	~10	-	-	0.6 FINE-MED SAND, TURBID				BROWN-CLOUDY, 31.3 NTU
1320	~10	-	-	0.5 FINE SAND, TURBID				BROWN-CLOUDY, 25.3 NTU
1325	~10	-	-	0.1 FINE SAND				CLOUDY, 10.6 NTU
1330	~10	-	-	<0.1	7.6	389	21.7	CLOUDY-CLEAR, 45.7 NTU
1330+	0							
1340	STARTED	AIRLIFT	~10 gpm					
1345	~10	-	-	4.0 GRAVEL				CLOUDY-CLEAR, 78.2 NTU
1350	~10	-	-	0.2 FINE SAND				CLOUDY-CLEAR, 13.9 NTU
1355	~10	-	-	0.2 FINE SAND				CLOUDY-CLEAR, 13.0 NTU
1400	~10	-	-	<0.1 FINE SAND				CLOUDY, 92.7 NTU
1400+	STOPPED	AIRLIFT	LOWERING AIRLINE TO ~840 FEET.					
1415	AIRLIFTING							
1420	~10	-	-	0.1 FINE SAND				CLOUDY, 61.8 NTU
1425	~10	-	-	<0.1	8.1	401	22.3	CLOUDY, 59.9 NTU
1425+	0	STOPPED	AIRLIFT	LOWERING PUMP TO 900 FEET				
1440	AIRLIFTING							
1445	~20	-	-	<0.1	8.04	394	21.5	CLOUDY, 99.5 NTU
1450	~20	-	-	<0.1	-	-	-	CLOUDY, 63.6 NTU
1452	0	STOPPED	AIRLIFT	LOWERING PUMP TO 940 FEET.				
1505	STARTED	AIRLIFT						
1510	~20	-	-	<0.1	-	-	-	CLOUDY, 86.5 NTU
1515	~20	-	-	<0.1	8.10	401	22.5	CLOUDY, 61.5 NTU
1520	~20	-	-	<0.1	-	-	-	CLOUDY, 92.5 NTU
1520+	0	STOPPED	AIRLIFT	TO FIX DIVERTER AND TO LOWER AIRLINE TO ~1000 FEET.				
Comments:								

Project Name: EXCELSIOR	Project No.: 36861
Well No.: NSH-024	Date: 2-2-2015
Location: NSH-DC	Measuring Point: -
Total Depth of Well (ft bls): 1440	Screen Interval (ft bls): OPEN 625-1440'
Pump Type/Setting (ft bls): AIRLINE, -1000'	Activity: AIRLIFT DEVELOPMENT
How Q Measured: VISUAL ESTIMATION	H&A Personnel: C. GARDNER

[illegible]

Comments:

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[illegible]



# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-025</u>	Date: <u>2/10/15</u>
Location: <u>NSH-DP</u>	Measuring Point: <u>Top of 1" PVC; 1.46' ALS</u>
Total Depth of Well (ft bls): <u>1551</u>	Screen Interval (ft bls): <u>1480-1551</u>
Pump Type/Setting (ft bls): <u>405200-30 0908'</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>Bucket/Watch</u>	H&A Personnel: <u>S. COLLINGS</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
610		638.10		6	7.92	1650	19.41	
615	2.50	822.7	0.08		7.92	1650	19.41	water rising very turb
620	2.25	805.9			8.35	968	19.51	
625	1.8	799.3			8.43	836	19.55	Lt Gray - very turb
630	2.1	791.4			8.39	886	20.42	turb over
635	2.3	787.1			8.31	979	20.50	
640	2.4	785.9			8.26	1147	20.53	Lt Gray - very turb
645	2.5	785.5			8.38	1296	20.31	
650	2.3	784.3			8.29	1442	20.56	
655	2.3	783.1			8.15	2431	20.79	Grayish brown Air
700	2.1	781.5			8.22	2438	21.48	Air
705	2.1	781.1			8.25	2376	21.51	Grayish brown Air
710	2.1	780.4			8.26	2324	22.13	
715	2.1	778.4			8.26	2278	22.24	Brown Air
720	2.3	779.3			8.25	2228	22.40	Brown Air
725	2.6	781.3			8.24	2207	22.86	Brown Air
730	2.3	781.8			8.24	2173	23.18	Brown Air
735	2.3	782.3			8.23	2136	23.22	Brown Air
740	2.2	782.5			8.24	2101	23.29	
745	2.2	782.1			8.22	2072	23.89	
750	2.5	782.9			-	-	-	
755								
800								
805								
810								

Comments:

## Page 1 of 1

[illegible]

Comments:

Attempts: ATTEMPTED TO ARRIVE WITHOUT SUCCESS

# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-027</u>	Date: <u>2-7-15</u>
Location: <u>NSH-BG</u>	Measuring Point: <u>TOP OF 1" PUC @ 1.85' dls</u>
Total Depth of Well (ft bls): <u>1010</u>	Screen Interval (ft bls): <u>865-1010</u>
Pump Type/Setting (ft bls): <u>85520-180849</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>EM FLOW METER</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft bwp)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F	Comments
1400	0	551.42						
1428	0	553.60						
1429+	STARTED PUMPING							
1431	93	SEEING WATER, ADJUSTING GATE VALVE						
1432	26							
1433	9							
1436	9.27	580.52	0.32	0.0				FORMY, 5529.1R
1442	9.16	580.85	0.31	-	-	-	-	DRILLING FLUID
1450	-	583.4						HAVE w/ FLOW METER
1450+	OPENED GATE VALVE TO PUMP							
1451	85	DIFFICULT TO SOUND w/ DRILLING FLUID						
1503	70	FLUSHING SANDING TUBE						
1512	68	HAVE w/ SOUNDER (PANTAL)						
1539	75	726.80	0.42	0.2				TURBID GRAY, FLOCCULATED ~250ml/L
1550	72	727.40	0.41	0.5				TURBID GRAY, FLOCCULATED ~150ml/L
1555	68	730.60	-	0.5				TURBID GRAY, FLOCCULATED ~125ml/L
1602	68	728.00	-	0.8				TURBID GRAY, FLOCCULATED, ~100ml/L
1610	67	728.18	-	-	-	-	-	
1615	68	728.45	-	-	-	-	-	
1620	68	728.00	-	-	-	-	-	
1625	66	729.75	-	0.3				TURBID GRAY, FLOCCULATED, ~80ml/L
1630	68	728.80	-	-	-	-	-	
1640	67	729.20	-	0.3				TURBID GRAY, FLOCCULATED ~100ml/L
1650	67	729.85	-	-	-	-	-	
1700	67	729.08	-	-	-	-	-	
1710	66	732.15	-	-	-	-	-	
1720	66	733.52	-	0.1	-	-	-	CLOUDY TO TURBID 284NTU
1730	67	729.70	-	-	-	-	-	TURBID GRAY, FLOCCULATED
1740	67	729.85	-	-	-	-	-	01738 ~100ml/L
Comments:								
01738 GPI PROBELEN/DIGITAL READS: 63.32 63.76								
MILNOMETER UMOL-02 READS: 106.71 106.95								
RELATIVE PERCENT DIFFERENCE: 5.2% 4.9%								



# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCURSION</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-027</u>	Date: <u>2-7-15</u>
Location: <u>NSH-B6</u>	Measuring Point: <u>TOP OF 1" PVC @ 1.85' als</u>
Total Depth of Well (ft bls): <u>1010</u>	Screen Interval (ft bls): <u>865-1010</u>
Pump Type/Setting (ft bls): <u>855700-18 *849</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>FM FLOW METER</u>	H&A Personnel: <u>C. GANDNER, C. PRICE</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F / °C	Comments
								STATIC 553.6 ft bwp
1750	66.7	730.00	0.38	0.2	7.16	438	21.8	TOTAL RESIDUAL CL = 0.54 mg/L
								NO OIL ON GRADES
1800	66.1	733.25	-	0.1	7.44	440	21.9	FLOCCULATED 60 ml/L
1815	66.5	731.38	-	-	-	-	-	- 30 ml/L
1840	66.7	729.84	-	0.1	-	-	-	- 40 ml/L
1900	66.9	729.54	-	0.1	-	-	-	- 60 ml/L
1915	66.7	729.04	-	0.1	-	-	-	35 ml/L Flockulate
1920	Pump OFF to recharge							
1937	-	591.24	-	-	-	-	-	
1940	Pump on							
1943	72.56	760.99	-	0.5	-	-	-	40 ml/L Flockulate
2012	68.65	716.44	-	5.0	-	-	-	80 ml/L Flockulate
2030	66.43	729.86	-	0.3	-	-	-	45 ml/L "
2045	66.68	730.64	-	0.1	-	-	-	65 ml/L
	62.05	Relative Percent Difference gpm =						7.19%
2106	67.30	727.34	-	20.1	-	-	-	52.5 turbidity - no Flockulate
2122	67.72	724.74	-	0.9	-	-	-	30 ml/L Flockulate
2144	67.5	725.64	-	0.4	-	-	-	40 ml/L Flockulate
2200	67.5	726.50	-	0.1	-	-	-	90 ml/L Flockulate
2201	Pump OFF							
2233		584.65						
2235	Pump on							
2237	77.3	652.89	-	0.4	-	-	-	no Flockulate
2248	72.9	687.19	0.55	0.7	-	-	-	"
Comments:								

# Pump DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-027</u>	Date: <u>2-7-15</u>
Location: <u>NSH-BG</u>	Measuring Point: <u>top of 1" DVC 1.85' AIS</u>
Total Depth of Well (ft bls): <u>1010</u>	Screen Interval (ft bls): <u>865-1010</u>
Pump Type/Setting (ft bls): <u>855700-18 849</u>	Activity: <u>Pump Development</u>
How Q Measured: <u>EM Flow Meter</u>	H&A Personnel: <u>C Price</u>

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content ml/5 (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F °C	Comments
								static 553.6' bmp
2300	70.0	706.82	—	0.2	—	—	—	no Flockulate
2320	67.5	727.35	—	20.1	—	—	—	Turbidity 303 NTU
2335	68.0	723.09	—	0.1	—	—	—	4 ml/L Flo no Flockulate
2345	67.4	725.43	—	20.1	—	—	—	957 NTU
0000	66.5	733.08	—	0	—	—	—	cloudy, no Flockulate 54.6 NTU
0015	66.3	734.02	—	0	6.74	378	20.6	33.7 NTU
0030	66.37	734.32	—	0	7.30	385	21.4	24.4 NTU
	62.2							
0045	66.2	734.55	0.33	0	7.37	386	21.6	cloudy w/air → clear 22.7 NTU
0100	66.0	734.46	—	0	7.33	385	22.0	17.4 NTU
0105	Pump off							
0120	Pump on @ ~10 gpm, reading 102.1 gpm							
0125	9.50	617.40	—	0.1	7.20	366	20.14	33.5 NTU
0130	9.60	605.72	—	20.1	7.4	384	21.0	433 NTU
0135	9.60	603.68	—	0	7.4	389	21.3	369 NTU
0140	9.71	600.92	—	0	7.4	387	21.6	171 NTU
0145	9.67	599.41	—	0	7.4	391	22.0	150 NTU
0150	9.69	597.72	—	0	7.5	393	22.0	139 NTU
0155	9.69	596.66	—	0	7.6	388	21.0	236 NTU 0.97 cl mg/L
0200	9.71	595.55	—	0	7.5	382	21.3	38.8 NTU
0205	9.70	594.76	—	0	7.5	379	20.7	10.9 NTU
0207	GPM increased to 20.1							
0209	19.31	604.14	—	0	7.5	391	22.2	9.61 NTU 0.19 cl mg/L
0215	18.41	607.74	—	0	7.5	—	—	clear
0220	18.03	607.01	—	0	7.5	404	23.8	clear 3.80 NTU
0225	18.04	606.65	—	0	7.4	410	24.4	cloudy w/air → clear
Comments: Relative Percent Difference GPM = 6.4% @ 0030								

## DEVELOPMENT FIELD DATA LOG

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Project Name: <i>EXCELSIOR</i>	Project No.: <i>36861</i>
Well No.: <i>NSH-028</i>	Date: <i>2-4-17</i>
Location: <i>NSH-BH</i>	Measuring Point: <i>—</i>
Total Depth of Well (ft bls): <i>800</i>	Screen Interval (ft bls): <i>OPEN 544 to 800</i>
Pump Type/Setting (ft bls): <i>AIRLIFT @ ~760'</i>	Activity: <i>AIRLIFT DEVELOPMENT</i>
How Q Measured: <i>VISUAL ESTIMATION</i>	H&A Personnel: <i>C. GARDNER</i>

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# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-028</u>	Date: <u>2/6/15</u>
Location: <u>NSH-BH</u>	Measuring Point: <u>TOP OF 1" PUC @ 0.25' abt</u>
Total Depth of Well (ft bls): <u>800</u>	Screen Interval (ft bls): <u>OPEN 544 to 800 FT</u>
Pump Type/Setting (ft bls): <u>405100 30 @ 750</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>BM FLOW METERS</u>	H&A Personnel: <u>C. GARDNER</u>

Time	Discharge (gpm)	Pumping Water Level (ft) bwp	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F / °C	Comments
1300	0	565.85						
1310	0	565.92						STATIC WATER LEVEL
1311	STARTED PUMPING							
1314	32	-	-	0.0	7.19	351	19.9	TUNING = 6.73 mtr
1315	30.82	622.5		-	-	-	-	
1319	25.48	664.8		-	-	-	-	
1322	22.94	688.1		-	-	-	-	McM = 27.80 gpm
1325	stuck	711.0		0.0	7.36	362	21.9	" = 26.51 gpm
1329	stuck	731.2						25.30 gpm
1330	ADJUST RATE TO ~10 gpm							
1332	8.92	773.4	?					
1335	3.59	746.6	CAMP	ADJUST LOWER w/				Mc = 4.07 gpm
1336	0		BALL VALVE.					1336:30
1339	0	732.00		CAMP RECONFIGURING DISCHARGE.				
1341	0	725.30						
1355	0	710.30						
1406	0	701.35						
1414	0	695.00						
1427	0	687.30						
1430	0	684.4						From ~5 gpm
1434	STARTED PUMPING, ADJUSTED RATE TO ~1 gpm							
1436	~1	705.80	too low	BM FLOW METERS				
1442	1.09	704.00						2 gals in 1:50 = 1.09 gpm
1446	1.04	702.60						2 gals in 1:55 = 1.04 gpm
1451	1.04	700.85						1:55
1456	1.09	699.25						1:50
1500	1.09	697.85						1:50
1506	1.09	696.25		0.0	7.62	356	21.0	1:50

Comments:

McM = McCrometer BM Flow Meter



# PUMP DEVELOPMENT FIELD DATA LOG

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Project Name: <u>EXCAVATOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSH-028</u>	Date: <u>2/6/15</u>
Location: <u>NSH-BH</u>	Measuring Point: <u>TOP OF 1" PVC @ 0.25' ab</u>
Total Depth of Well (ft bls): <u>800</u>	Screen Interval (ft bls): <u>OPEN 544 - 800</u>
Pump Type/Setting (ft bls): <u>405100-30 @ 750'</u>	Activity: <u>PUMP DEVELOPMENT</u>
How Q Measured: <u>TIME TO FILL BUCKET</u>	H&A Personnel: <u>C. GANNON</u>

Time	Discharge (gpm)	Pumping Water Level (ft) bwp	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °F / °C	Comments
1513	1.09	694.55	TOTAL PERMANENT CHANGE				0.07 °F	2gal in 1:50 4.09 NTU
			NO OIL AND GREASE					
		682.2						
1521	1.09	692.60						2gal in 1:50
1540	~1.1	688.65						
1545		687.31						2gal in 1:48.41
1550		686.36						
1555		685.47						2gal in 1:46.19 1:46.19
1600		684.52						
1605		683.70						2gal in 1:47.03
1610		682.98						
1615		682.26						2gal in 1:46.70
1620		681.68						
1625		681.10						2gal in 1:44.37
1630	~2	680.22	~1631	ADJUSTING RATE				2gal in 1:05 1:05
1637		681.10						2gal
1640		681.42						2gal in 1:00
1645		681.91						
1650		682.51						2gal 59.51
1655		683.05						
1700		683.52						2gal 1:01.88
1705		684.32						
1710		684.87						2gal 1:01.16
1715		685.48						
1720		686.05						2gal 1:01.38
1725		686.65						
1730	✓	687.21						2gal 1:01.22
1735		688.68						
Comments:								

## DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.: 38681
Well No.: N5H-028	Date: 2/6/15
Location: N5H-3H	Measuring Point: TOP OF 1" PVC
Total Depth of Well (ft bbs): 800	Screen Interval (ft bbs): approx 544-800
Pump Type/Setting (ft bbs): 405100-30 @ 750'	Activity: PUMP DEVELOPMENT
How Q Measured: TIME TO FILL BUCKET	H&A Personnel: C. GARDNER

[illegible]



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior</u>	Project No.: <u>36861</u>
Well No.: <u>NSH-029</u>	Date: <u>2/8/15 - 2/19/15</u>
Location: <u>NSH-DQ</u>	Measuring Point: <u>—</u>
Total Depth of Well (ft bls): <u>709.4</u>	Screen Interval (ft bls): <u>604 - 709.4</u> bgs
Pump Type/Setting (ft bls): <u>Ba, ling</u>	Activity: <u>Air Lift Development</u>
How Q Measured: <u>Visual Estimate</u>	H&A Personnel: <u>Nielsen</u>

[illegible]

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$$2191\overline{4}$$
9



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Oxelson</u>	Project No.: <u>32681</u>
Well No.: <u>NSH-031</u>	Date: <u>3/6/15</u>
Location:	Measuring Point: <u>TOP OF 2" CASING @ 1.92' ab</u>
Total Depth of Well (ft bls): <u>805</u>	Screen Interval (ft bls): <u>721 - 805</u>
Pump Type/Setting (ft bls): <u>NA</u>	Activity: <u>WELL DEVELOPMENT</u>
How Q Measured: <u>BAL</u>	H&A Personnel: <u>C. GANNON, T. NELSON</u>

[illegible]

Project Name: EXCELSIOR	Project No.: 38681
Well Site: NSH-032	Date: 2-23-15 to 2-24-15
Location: NSH	Measuring Point: TOP OF 2" CSG (1.96 ft als)
Total Depth of Well (ft, bls): 1277	Screen Interval (ft bls): 1180 - 1260
Pump Type/Setting (ft, bls): AIRLINE	Activity: AIRLIFT DEVELOP
How Q Measured: VISUAL ESTIMATE	H&A Personnel: C GARDNER

[illegible]

Additional Comments:

## **APPENDIX D**

**Geophysical Logs  
(provided in separate PDF)**

## **APPENDIX E**

### **Corehole Cleanout Records**



# DEVELOPMENT FIELD DATA LOG

Project Name: <u>Excelsior Mining</u>	Project No.:
Well No.: <u>LS-37</u>	Date: <u>12/5/14 / 12/8/14</u>
Location:	Measuring Point: <u>GS</u>
Total Depth of Well (ft bls): <u>(1200) 800?</u>	Screen Interval (ft bls): <u>open hole 524-800?</u>
Pump Type/Setting (ft bls): <u>air line 1.5"</u>	Activity: <u>Purging</u>
How Q Measured: <u>estimated visually</u>	H&A Personnel: <u>O. Miles</u>

Time	Discharge (gpm) <i>gallons</i>	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. <i>°F</i>	Comments
	Air line to 440' BS.							
1230	50		110	0.6	8.9	0250	18.5	Black turbid water
1240	Air again. no return: limited recovery in well							
1255	~50		250	~0.5	8.9	270	22.0	Black/dark water
1305	~50		350	~0.5	8.5	730	20.9	Foam on surface
1312		534						Still foamy, dark grey
1313		524						
1317		500						
1347		462						
1350	~50							Still turbid
1400	~50							
1410	~60							
1415	~60							rocks + gravel
1450	~60-70	pumping						
1500	~15-20							Below 714 water
1525	Same Brown drilling mud.							
1600	lowered 42'		0.7	270	7.9	570	20.6	produced constantly
1705	much clearer - cloudy							some sand and chips in return water.
1730	Pure off.							same water: cloudy, some sand + chips.
0920	~60-70							lots of rock chips in return + Drilling mud
0945	~80-90							Same as above lots of rock in return. moving up
								to not lose the hole.
1030	~30		290	2-3	7.4	600		Brown cloudy
1115	~20		270	1.0	7.9	560		Reduced oil flow
1200	~10-15		260	0.5	8.0	530		cloudy.
1230	~10		250	0.3	8.1	530	23.6	Slightly cloudy
1505	~10		240	0.2	8.1	540	23.5	Slightly cloudy

## Comments:

Total purge time ≈ 4 hours pumping on 12/5/14  
 total volume ≈ 2000-2500 Gallons.  
 lots of mud at the start (Foam) By the end no mud. cloudy some sand.



## DEVELOPMENT FIELD DATA LOG

Project Name: <i>Gunnison/Excelsior</i>	Project No.: <i>38681-113</i>
Well No.: <i>NSD-001</i>	Date: <i>12/12/14</i>
Location:	Measuring Point:
Total Depth of Well (ft bls): <i>1509</i>	Screen Interval (ft bls): <i>460-1509 (apa) wide PVC 2"</i>
Pump Type/Setting (ft bls):	Activity:
How Q Measured: <i>Visual estimate</i>	H&A Personnel: <i>C. Mares</i>

[illegible]

# DEVELOPMENT FIELD DATA LOG

Project Name: <i>Excelsior/Garrison</i>	Project No.: <i>38681-113</i>
Well No.: <i>NSD-002</i>	Date: <i>12/10/14</i>
Location:	Measuring Point:
Total Depth of Well (ft bls): <i>1906</i>	Screen Interval (ft bls): <i>3 - 1906</i>
Pump Type/Setting (ft bls):	Activity:
How Q Measured:	H&A Personnel: <i>OMI</i>

[illegible]

Comments:



# COREHOLE DEVELOPMENT FIELD DATA LOG

Project Name: <i>Excelsior / Gunnison</i>	Project No.:
Well Site: <i>NSD-026</i>	Date: <i>12/9/14</i>
Location: <i>Near highway N side</i>	Cased Depth (ft, bls): <i>431</i>
Total Depth of Corehole (ft, bls): <i>1168</i>	Measuring Point:
How Q Measured: <i>Estimated</i>	Staff: <i>O. Miles</i>

[illegible]

Additional Comments:

## DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXLERSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>MSD-027</u>	Date: <u>1-6-15</u>
Location:	Measuring Point:
Total Depth of Well (ft bls): <u>1004</u>	Screen Interval (ft bls): <u>CASING TO 400', OPEN HOLE</u>
Pump Type/Setting (ft bls): <u>AIRLIFT FROM 960'</u>	Activity: <u>AIRLIFT OVERSOP</u> <u>COMPLETION</u>
How Q Measured: <u>VISUAL ESTIMATION</u>	H&A Personnel: <u>C. GARDNER</u> <u>K. FORD</u>

[illegible]

Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: <u>EXCELSIOR</u>	Project No.: <u>38681</u>
Well No.: <u>NSD-028</u>	Date: <u>1-9-15</u>
Location:	Measuring Point:
Total Depth of Well (ft bls): <u>755'</u>	Screen Interval (ft bls): <u>open hole 400 - 755'</u>
Pump Type/Setting (ft bls): <u>AIRLIFT FROM 740' bls</u>	Activity: <u>AIRLIFT DEVELOP</u>
How Q Measured: <u>VISUAL</u>	H&A Personnel: <u>KENDRA FORD</u>

Time	Discharge (gpm)	Pumping Water Level Depth (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (µmhos/cm)	Temp. °C	Comments
1040		START AIRLIFTING						black
1045	~9	740		10				dark grey, turbid
1048		STOP, RECOVER 15 min						
1100		START AIRLIFTING						Black / dk grey
1103	~9			0.8	TURBID, FLOCC			dark grey, turbid, flocc (sed)
1115	~9			0.3	TURBID, FLOCC			dark grey (lighter), turbid to cloudy
1125	~9			0.2	TURBID			grey, turbid to cloudy
1136	~9			0.7	TURBID, FLOCC			Black, turbid / flocc (sed)
1145	~9			0.1	TURBID			grey, turbid to cloudy
1155	0	STOP, RECOVER						
1220		START AIRLIFTING						
1225	~9			0.2	TURBID			dark grey, turbid
1245	~9			0.1	TURBID			grey, turbid to cloudy
1300	~9			0.1	TURBID			grey, turbid to cloudy
1314	~9			0.1	TURBID			grey, turbid to cloudy
1330	~9			0.1	TURBID			grey, turbid to cloudy
1355	0	STOP, RECOVER						
1410		START AIRLIFTING						
1414	~9			0.2				grey, cloudy
1432	~9			0.1				grey, cloudy
1445	~9			0.1				grey, cloudy
~1500	~9			<0.1	8.1	560		lighter grey, cloudy
1530	0	STOP, RECOVER						
1549		START AIRLIFTING						
1552	~9			0.1	8.0	570	20.0	(lighter) grey, cloudy
1606	~9			<0.1	8.1	560	22.1	grey, cloudy
1620	~9			<0.1	8.2	630	22.3	light grey, cloudy
1635	~9			<0.1	8.2	570	20.8	light grey, cloudy
Comments:								

## DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.: 38681
Well No.: NSD-028	Date: 1-8-15
Location:	Measuring Point:
Total Depth of Well (ft bls): 755'	Screen Interval (ft bls): open hole 400-755'
Pump Type/Setting (ft bls): AIRLIFT FROM 740 & 1/2	Activity: AIRLIFT DEVELOP
How Q Measured: VISUAL	H&A Personnel: KENDRA FORD

[illegible]



11/21/14  
 RW 0815  
 GG RW 0850

NSD-030

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# DEVELOPMENT FIELD DATA LOG

Diam Bit = 3.7"  
 = 0.56 gallons / ft

Project Name: GUNNISON	Project No.:
Well No.: NSD 030	Date: 11/21/14
Location: NORTH OF FREEDOM	Measuring Point:
Total Depth of Well (ft bls): 767	Screen Interval (ft bls):
Pump Type/Setting (ft bls): NA	Activity:
How Q Measured: Bucket	H&A Personnel: G. FUSHEE CHRIS HARDNER

TDS

Time	Discharge (gpm)	Pumping Water Level (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)	pH	Sp. Cond. (umhos/cm)	Temp. °F	Comments
1312	~1	—	—	TR	7.9	500	19.8	Began surging @ 14
1535	~1	—	—	TR	7.6	590	19.9	
1504	0.1	—	—	TR	7.9	590	16.6	15 min. intervals
1611	~1	—	—	TR	7.7	560	19.0	
1619	~1	—	—	Tr	7.6	490	19.5	
1628	~1	—	—	Tr	7.7	570	19.6	
1635	~1	—	—	Tr	7.6	500	18.9	SURGE W/ WELLHEAD
1648	~1	—	—	TR	7.7	490	19.9	Sign. Misch. From 60'
1703	~1	—	—	Tr	7.8	550	18.6	MILKY FORM / From wellhead
1715	NO READINGS - ON PHONE w/ CG							
11/22/14 1020	~1	—	—	500ppm	7.4	680	20.4	FIRST TIME w/ new set up
1053	~1	—	—	120 ppm	7.9	600	21.4	suspect DAMAGING Borehole
1130	~1	—	—	20	7.9	620	20.5	
1150	~1	—	—	20	7.7	598	20.9	
1200	5 gpm	—	—	10	7.8	360	20.7	Thremo ON 90° FLOW MCHS.
1220	5	—	—	3	7.9	500	20.6	
1240	5	—	—	20	7.9	540	20.6	
1300	5	—	—	10	7.8	520	20.0	
1320	5	—	—	20	7.8	520	19.8	TDS
1340	10	—	260	5	7.3	540	20.2	24RB CALIBRATED @ 1340
1400	10	—	260	8	7.6	540	20.8	
1420	10	—	250	10	7.9	550	21.2	
1440	10	—	250	8	7.9	550	21.6	
1500	10	—	250	10	7.9	550	20.8	
1520	10	—	250	5	7.7	550	20.1	
1540	10	—	240	6	7.9	570	19.4	
1600	10	—	240	3	8.0	490	20.2	
1630	10	—	230	3	7.9	500	19.2	
1700	10	—	250	—	8.0	530	19.0	
Comments: SAMPLE IN RADIONUCLIDES, TOC, INORGANIC CHEM, SO <sub>4</sub> , NO <sub>x</sub> , ALK+BIOM, NITRIDE @ 1700								
~3000 GALLONS PURGED > 10 CV								

SNL INITIAL = 3585, TD = 767

SPD INTERVAL = 409.2

1 CV = 230 GAL

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Project Name: <u>Exordior</u>	Project No.: <u>38681-117</u>
Well Site: <u>NSD-041 (NSD-V)</u>	Date: <u>12/14/14</u>

[illegible]

Project Name:	Project No.: 38681-113
Well Site: NSD-042	Date: 12/15/14 // 12/16/14
Location: NSD-5	Cased Depth (ft, bls):
Total Depth of Corehole (ft, bls): ~1700	Measuring Point:
How Q Measured: Estimated.	Staff: C. Miles

[illegible]

Project Name: <i>Excelsior</i>	Project No.: <i>38681-113</i>
Well Site: <i>NSM-005a</i>	Activity:
How Q Measured:	Staff: <i>Ryle Mahan</i>

[illegible]

Additional Comments:

# DEVELOPMENT FIELD DATA LOG

Project Name: EXCELSIOR	Project No.: 38681
Well No.: NSM-006	Date: 2-16-15
Location:	Measuring Point:
Total Depth of Well (ft bls):	Screen Interval (ft bls):
Pump Type/Setting (ft bls): 960 Ft	Activity: DEVELOPMENT
How Q Measured: VISUAL ESTIMATE	H&A Personnel: KFORIS

[illegible]

Project Name: <u>Excelsior</u>	Project No.: <u>38681</u>
Well No.: <u>NSM-008</u>	Date: <u>2/10/15 - 2/11/15</u>
Location:	Measuring Point: <u>-</u>
Total Depth of Well (ft bls): <u>1250</u>	Screen Interval (ft bls): <u>open hole below 540 ft</u>
Pump Type/Setting (ft bls): <u>Air lift from 900 ft</u>	Activity: <u>Air lift</u>
How Q Measured: <u>Visual Estimate</u>	H&A Personnel: <u>J. Nielsen</u>

[illegible]

# COREHOLE DEVELOPMENT FIELD DATA LOG

Project Name: Gunnison Explorer	Project No.: 38687-113
Well Site: NSM-009	Date: 12-17-94

[illegible]

Additional Comments:





